SERVICE
MANUAL
1948-1952
FORD TRACTOR
MODEL 8N

SERIAL NUMBERS

	8N
1947	1
1948	37908
1949	141370
1950	245637
1951	343593
1952	442035

Ford Motor Company

Form 3730-47J

October 7, 1947

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SERVICE
MANUAL
1948-1952
FORD TRACTOR
MODEL 8N

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Form 3730-47J **October 7, 1947**

FOREWORD

This manual contains information and instructions for the overhaul or repair of the Model 8N Ford tractor. No attempt has been made in this manual to cover the procedures necessary to remove any assembly from the tractor which are covered fully in the Tractor Operator's Manual. The procedures given here start with the assembly being repaired already removed.

Each Chapter of this manual covers the disassembly, repair, and reassembly of one or more of the major subassemblies as shown in the Table of Contents.

Under the headings, "Inspection," "Repair," and "Assembly," a complete inspection of each part is included.

Numbers appearing in the various illustrations in bold type are basic part numbers.

This is a Repair Manual and the word "repair" is used to indicate "restore to good working condition" rather than to a "like new" condition.

FORD MOTOR COMPANY
Service Department

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Chapter

I

DESCRIPTION AND SPECIFICATIONS

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Description 111
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111. DESCRIPTION.

The Model 8N Ford tractor is provided with a steering gear assembly of the automotive ball nut type. It is a highly efficient, easily serviced unit which is readily adjustable to compensate for wear. This steering gear has a low driver fatigue factor because of easy steering and a minimum of road shock.

The tractor is equipped with a four forward and one reverse gear transmission. The transmission contains constant-mesh helical gears, assuring quiet running and providing for long life.

The power take-off is driven from the transmission countershaft. A power take-off adapter is available to extend the shaft when such extension is necessary for fitting certain implements. The adapter meets the American Society of Agricultural Engineers' specifications for a standard tractor hitch. Any implement built to these standards may be hitched to the Ford tractor without the purchase of additional accessories.

The tractor hydraulic system consists of a piston pump driven directly by the power take-off shaft, and a self-contained hydraulic unit which includes the ram cylinder and control linkage. The hydraulic pump and unit are located in the center housing and employ the transmission oil as the hydraulic fluid. This design reduces the possibility of external oil leakage, and greatly reduces repair costs.

The belt pulley assembly is self-contained, and is driven by the power take-off shaft. The pulley assembly is easily mounted on the tractor and has a separate oil supply.

The differential assembly is of the heavy duty truck type, and is driven by the transmission main shaft. The differential furnishes the power directly to the semi-floating rear axles.

112. SPECIFICATIONS.

The following specifications are given as an aid to the mechanic in repairing the Model 8N Ford tractor.

a. General.

Type	4-wheel, general purpose

Wheelbase	70 in. at 48 in. tread width
Over-all length, front to drawbar	115 in.
Over-all height	54½ in.
Over-all width, normal tread	64¾ in.
Tire size:	
Front	4.00 x 19—4 ply
Rear	10.00 x 28—4 ply
Front tread	48 to 76 inches in 4-inch steps
Rear tread	48 to 76 inches in 4-inch steps
Ground clearance:	
Front axle	21 in.
Rear axle	21 in.
Center	13 in.
Turning circle radius (with use of brakes):	
Made by outer front wheel	8 ft.
Made by centerline of tractor at rear axle	3½ ft.
Shipping weight (including gasoline, oil, water, tires filled with air, operator not included)	2,410 lbs.
Drawbar height	8½ to 34¼ in., 18 in. standard setting

Gear Ratio	Final Gear Reduction	Speeds at 1500 R.P.M.	Speeds at 2000 R.P.M.
1 Low (first)	73.33 to 1	2.54 M.P.H.	3.40 M.P.H.
2 Plowing (second)	57.04 to 1	3.28 M.P.H.	4.37 M.P.H.
3 Cultivating (third)	41.45 to 1	4.51 M.P.H.	6.02 M.P.H.
4 High (Fourth)	19.86 to 1	9.40 M.P.H.	12.54 M.P.H.
5 Reverse	44.64 to 1	4.19 M.P.H.	5.58 M.P.H.

b. Capacities—U. S. Measure.

Fuel tank	9 gals. standard 1 gal. reserve 10 gals. total
Engine oil pan (less filter absorption)	6 qts.
Transmission, hydraulic lift, and differential	5 gals.
Cooling system	12 qts.
Oil bath air cleaner	Fill to indicated level
Belt pulley	1 qt.
Tire pressure:	
10.00 x 28—4 ply	12 lbs.
4.00 x 19—4 ply	26 lbs.

c. Engine.

Type	4-cylinder "L" head
Rated speeds	1500 and 2000 R.P.M.
Idle speed	400 R.P.M.
Cylinder bore	3.188 in.
Stroke	3.75 in.
Piston displacement	119.7 cu. in.
Torque	84 lbs. ft. at 1500 R.P.M.
Compression ratio	6.0 to 1
Sleeves	Dry type
Piston	Cast steel
Rings:	
Compression	2
Oil	1
Piston pin	Full floating
Rod bearings	Replaceable shell-type
Main bearings	Replaceable shell-type
Crankshaft	Cast steel, static and dynamic balanced
Compression pressure at cranking speed (sea level)	90 lbs. minimum

d. Ignition System.

Type	Battery
Distributor:	
Firing order	1-2-4-3
Drive	Directly by camshaft
Automatic spark advance	Centrifugal governor
Initial timing (degrees of crankshaft)	Top dead center
Maximum advance (degrees of crankshaft)	24°
Distributor breaker cam	4 lobe
Breaker contacts	1 set
Breaker contact spacing	0.015 in.
Spark plugs:	
Type	Marked H-10
Size	14 mm
Gap	0.025 to 0.028 in.

e. Carburetor.

Type	Single up-draft
Idle fuel adjustment	1 screw
Main fuel jet	1 screw
Idle speed	1 screw

f. Governor.

Type	Variable speed, mechanically operated, centrifugal type
Governed speed range	800 to 2200 R.P.M.
Maximum governed speed adjustment	1 screw

g. Cooling System.

Radiator cap (pressure type):—	
Pressure valve opens at	3¼ to 4¼ lbs. per sq. in.
Vacuum valve opens at	½ to 1 lb. per sq. in.
Water Pump:	
Type	Centrifugal
Drive	V-belt
Fan:	
Type	6-blade pull
Drive	V-belt
Thermostat:	
Location	Cylinder head outlet hose
Starts to open	160-165° F.
Fully open	190-200° F.

h. Electrical System.

Generator:	
Type	3-brush
Drive	V-belt
Rating:	
1500 Engine R.P.M.	10 amps
Maximum output	11 amps
Capacity	119 watts
Generator regulator:	
Cutout closing voltage	6.0 to 6.3 volts
Voltage regulation	7.0 to 7.3 volts
Battery:	
Type	6-volt
Drive	Automatic engagement

i. Transmission.

Type	Constant mesh
Release bearing (pre-lubricated)	Ball bearing
Pedal free travel	¾ in.

j. Rear Axle.

Type	Semi-floating
Ratio	6.66 to 1

§ 112. k.

k. Brakes.

Type	Internal expanding
Control	Individual, mechanical
Adjustment at each wheel	1 screw
Brake pedal free play	¾ in.
Thickness of lining	0.187 in.
Width of lining	2.000 in.
Length of lining	12.910 in.
Total brake lining area (two wheels)	103.3 sq. in.

l. Steering Gear.

Type	Automotive ball nut
Ratio, turns of steering wheel for total travel of pitman arms, at 48 in. wheel tread	2.25
Steering wheel diameter	18 in.

m. Hydraulic System.

Type	Internal
Maximum pressure	1500-1700 lbs. per sq. in.
Pump:	
Type	Scotch yoke piston
Drive	Direct power take-off shaft
Capacity:	
2000 engine R.P.M.	2.85 gals. per min.
1500 engine R.P.M.	2.15 gals. per min.
Control	Manual and automatic
Oil supply	Transmission and differential

n. Power Take-off Adapter.

Spline	1⅜
Speed (1500 Engine R.P.M.)	545 R.P.M.

o. Belt Pulley.

Pulley speed (2000 engine R.P.M.)	1358 R.P.M.
Belt speed (2000 engine R.P.M.)	3199 ft. per min.
Pulley size (standard)	9 in.

Chapter

II

STEERING GEAR

Section
Adjustments 121
Disassembly 122
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Assembly 124

The steering system includes the steering gear, steering wheel, and steering drag links between the pitman arms and the front axle spindle arms. The steering gear is of the recirculating ball bearing worm and nut type. Anti-friction steering is achieved by steel balls which serve as rolling contacts between the worm and nut.

Rotation of the steering tube shaft moves the ball nut along the worm. The left steering sector engages the rack on the ball nut, and is thereby rotated through an arc by the movement of the ball nut (fig. 2). The right sector engages the left sector and rotates the same number of degrees in the opposite direction. The pitman arms transfer the motion of the sector to the spindle arms through the drag links.

121. ADJUSTMENTS.

When the wheels are in the straight ahead position, all backlash should be removed, but if the wheels are turned to the extreme right or left, a slight backlash will be present due to the gear tooth design. This characteristic permits a backlash adjustment for wear between the worm nut teeth and the sector gears in the much used center position without causing binding or tightness in less used portions of the sector gears and worm nut.

Steering gear adjustments may be checked before removing the unit from the tractor or disassembling the unit. Adjusting the steering gear on the tractor in many cases will eliminate excessive backlash caused by improper adjustment between the sectors and the ball nut.

To determine the cause of excessive backlash, first check the adjustment of the steering tube bearings. Disconnect the drag links from the pitman arms. Turn the steering wheel to the right or left to the end of its travel, then back about ½ turn. Measure the force required to rotate it by use of a spring scale attached to the rim (fig. 7). If a force from ½ to 1½ pounds will maintain the wheel in motion during the next ½ turn toward the center position, the tube shaft bearings do not require adjustment. Proceed as instructed in pars. a and **b** below. If no adjustment is required, proceed as instructed in par. **b** only.

a. Steering Tube Shaft Bearing Adjustment. The actual adjustment of the steering tube shaft bearings requires the removal of the steering gear from the tractor.

(1) *REMOVE STEERING GEAR.* Remove the steering wheel with a puller.

To remove the hood, shut off the fuel at the fuel shut-off valve, and disconnect the fuel line to the carburetor. Remove the four cap screws that secure the hood to the instrument panel. Remove the cap screws that secure the hood to the front axle support. Remove the intake air screen and connection. Lift off the hood.

Remove the air cleaner, tool box, battery, battery box, and choke rod.

Disconnect the throttle rod at its rear end, the governor compensating spring at the housing end, the starter wire at the switch end, and the oil line at the oil gauge.

Remove the two bolts that secure the steering gear to the instrument panel. Lift the instrument panel assembly off the steering shaft, but do not detach any of the wiring.

Remove the four bolts at the base of the steering gear, and lift out the assembly.

(2) *ADJUST STEERING TUBE SHAFT BEARINGS.* Remove the four cap screws that secure the steering tube to the steering gear housing. Pull the steering tube upward to remove or install shims as required. Shims vary in thickness and only those of the correct thickness must be removed or added to complete the adjustment. For example, if the spring scale reading was approximately ¼ pound, only one of the thinnest shims need be removed. It is better to have the bearings adjusted tightly rather than loosely, because loose bearings permit hammering and produce subsequent failure.

Reassemble the steering gear, and check the adjustment as outlined above.

b. Sector Adjustment. If the steering wheel has been removed, it must be installed temporarily to complete the sector adjustment.

Turn the steering wheel until the pitman arms are parallel and both point to the rear approximately 15°. Hold the steering wheel in this position, and feel for backlash by grasping the left pitman arm. If no backlash is apparent, no adjustment is required. If backlash is present, adjust the left sector.

§ 121. b.

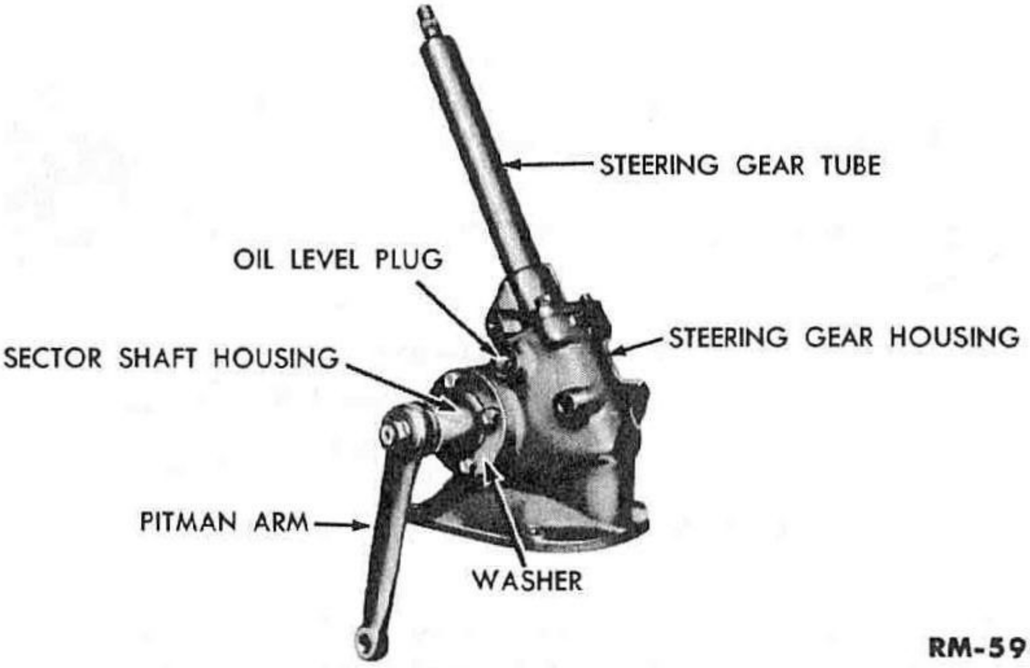

Fig. 1—Steering Gear Assembly

Remove the four cap screws that secure the sector shaft bearing housing to the steering gear housing, and turn the sector shaft bearing housing and its metal gasket counterclockwise (as viewed from the left side of the tractor) to the next set of notching holes. Replace and tighten the four cap screws.

Check the effect of the adjustment by measuring the force required to turn the steering wheel through the straight ahead position, with the pitman arms parallel. This measurement is taken with a spring scale as described above. Two to three pounds should be required to maintain the steering wheel in motion through the straight ahead position.

It is usually necessary to adjust the right sector if the left has been moved. Proceed as instructed for the left sector, except that the right sector shaft bearing housing must be turned in a clockwise direction, as viewed from the right side of the tractor, to remove excessive backlash. 2½ to 6 pounds should be required to maintain the steering gear in motion through the straight ahead position after both right and left sectors have been adjusted.

122. DISASSEMBLY.

To disassemble the steering gear, remove the nut that secures each pitman arm to the sector shafts. Remove each pitman arm with a puller. Remove the four cap screws that secure each sector shaft housing to the steering gear housing. Lift each sector shaft housing, thrust washer, gasket, and sector shaft from the steering gear hous-

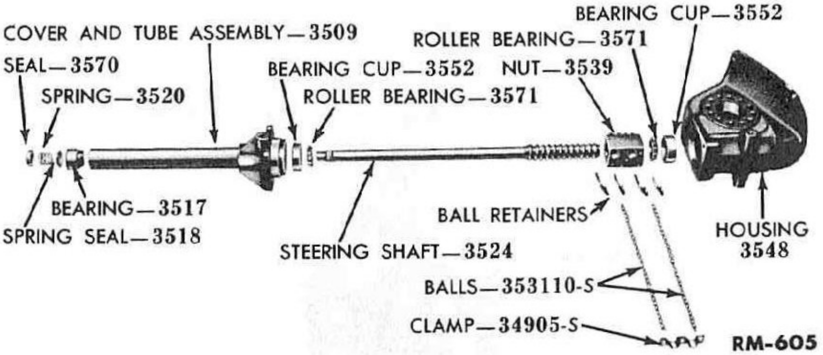

Fig. 2—Steering Tube Shaft, Disassembled

ing. Remove the four cap screws that secure the steering tube to the steering gear housing. Lift the tube and shaft assembly (fig. 1) from the housing.

CAUTION: ***When the steering gear is partially or completely disassembled, the ball nut assembly must not be permitted to turn so that it reaches the end of the worm on the steering shaft as this action may damage the ball retainer.***

Remove the three screws and clamp from the ball nut assembly (fig. 2). Lift the two ball retainers from the assembly and remove the ball bearings.

123. INSPECTION AND REPAIR.

Before inspection, clean all parts thoroughly in cleaning fluid and blow them dry with compressed air.

a. Inspection. Inspection of the steering gear must cover the following seven items:

(1) *STEERING TUBE.* Replace the steering tube (fig. 2) if it is bent or otherwise damaged. Replace the bearing race if it is scored or pitted. If the bearing at the top of the steering tube is damaged, it must be replaced.

(2) *ROLLER BEARINGS.* Replace a roller bearing if any of the rollers have flat spots, or if any of the rollers are missing.

(3) *STEERING TUBE SHAFT AND BALL NUT.* The individual parts of the steering shaft and ball nut must be inspected to determine the condition of the assembly.

(*a*) STEERING TUBE SHAFT. Replace the entire steering shaft and ball nut assembly if the worm on the shaft is pitted or otherwise damaged.

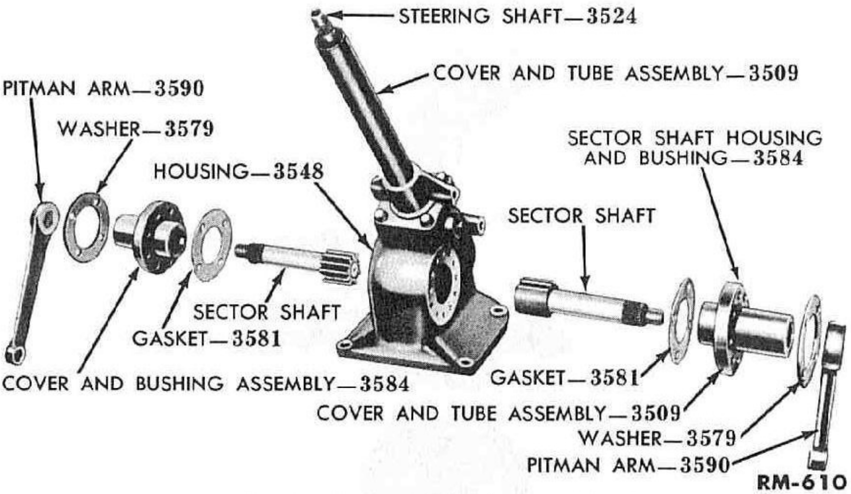

Fig. 3—Sector Shafts, Disassembled

(*b*) Ball Nut. Replace the entire steering shaft and ball nut assembly if the teeth are worn or if the ball race is pitted.

(*c*) Ball Bearings. Replace the entire steering shaft and ball nut assembly if any balls are worn, chipped, or pitted. Be sure that there are 60 balls within the assembly. Since these balls are held to a very close tolerance, it is not advisable to replace them individually.

(*d*) Ball Retainers. Replace the retainers if they are bent, damaged, or will not permit free passage of the balls.

(4) *STEERING GEAR HOUSING*. Replace the steering gear housing (fig. 3) if it is cracked or otherwise damaged. Replace the lower steering shaft bearing race if it is scored or pitted.

(5) *PITMAN ARM*. Replace a pitman arm (fig. 3) that has been damaged in any way.

(6) *SECTOR SHAFT HOUSING*. Replace the housing if it is damaged. Replace the sector shaft bushings if they are damaged or worn.

(7) *SECTOR SHAFT*. Replace a sector shaft (fig. 3) if the teeth or bearing surface are excessively worn.

b. **Repair.** To replace a bearing race, remove it from the housing or steering tube shaft with a puller. To install a bearing race, press it in place, making sure that it is seated firmly against the shoulder in the housing or steering tube.

To replace a sector shaft bushing, remove the seal and seal washer, then press the bushing from the housing, being careful not to damage the bore. Press the new inner bushing into the housing until

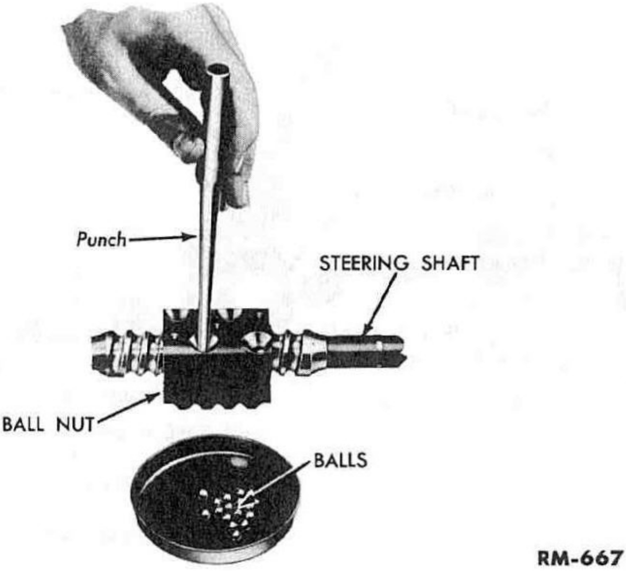

Fig. 4—Aligning Ball Nut on Steering Tube Shaft

it is ⅛ inch below the face of the hub. Press the new outer bushing into the housing until it is level with, or slightly below, the bottom of the counterbore. Line ream both bushings in place to 1.125-1.126 inches in diameter.

124. ASSEMBLY.

Assembly should be accomplished only when inspection shows that every part is in a serviceable condition.

a. Steering Tube Shaft and Ball Nut. Place the steering shaft on a bench and position the nut over the middle section of the worm with the ball retainer holes on top. Align the ball retainer holes with the grooves in the worm on the steering shaft (fig. 4). Drop 20 balls into one of the retainer holes, then slowly rotate the steering shaft to carry the balls away from the hole. Continue dropping the balls into the hole until the ball circuit is full to the bottom of both holes or until the end of the steering shaft worm has been reached. Where the balls were stopped by the end of the worm, they should be held in position with a clean, blunt tool while the steering shaft is rotated in the opposite direction. This will make it possible to drop more balls into the retainer hole. Extreme care should be exercised to make certain that no balls are outside the regular ball circuits. If balls

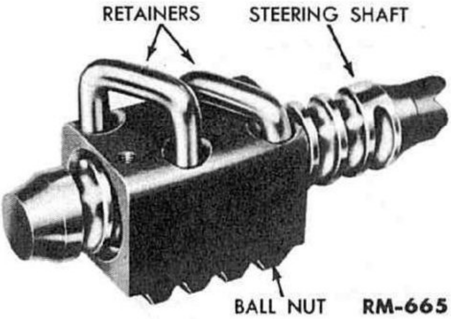

Fig. 5—Removing or Installing Ball Retainer

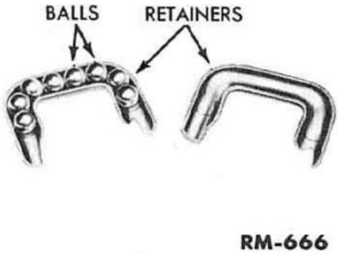

Fig. 6—Filling Ball Return Guide

remain in the groove between the two circuits, or at the ends, these balls cannot circulate and will cause ultimate failure of the steering gear.

It may be necessary to rotate the steering tube shaft alternately in both directions while, at the same time, holding the balls in place. This will make it possible to completely fill the ball circuit.

Lay one-half of the retainer on the bench, and fill it with 10 balls for the circuit being filled. Position the other half of the retainer over the balls, plug the ends with heavy grease, and insert the retainers into the retainer holes in the nut (fig. 6).

The second ball circuit is filled in the same manner.

Install the retainer clamp and three screws.

b. Installing and Adjusting Steering Tube Shaft and Sectors. Position a roller bearing in the bearing race in the housing on the upper bearing race of the shaft (fig. 2).

Place shims on the housing to an approximate thickness of 0.050 inch. Hold the steering tube shaft and ball nut assembly in place in the housing, with the rack teeth toward the sectors and the ball nut in the approximate center of the worm. Install the steering tube. Do not tighten the bolts so tight that damage to the bearings will result, especially when an insufficient thickness of shims have been used. Install the steering wheel and measure the force required to rotate it. This should be from 1 to 1½ pounds on a spring scale (fig. 7). Add or remove shims as required until the correct force is obtained. Be sure that the pulling force of the scale is at right angles to a steering wheel spoke when taking measurements.

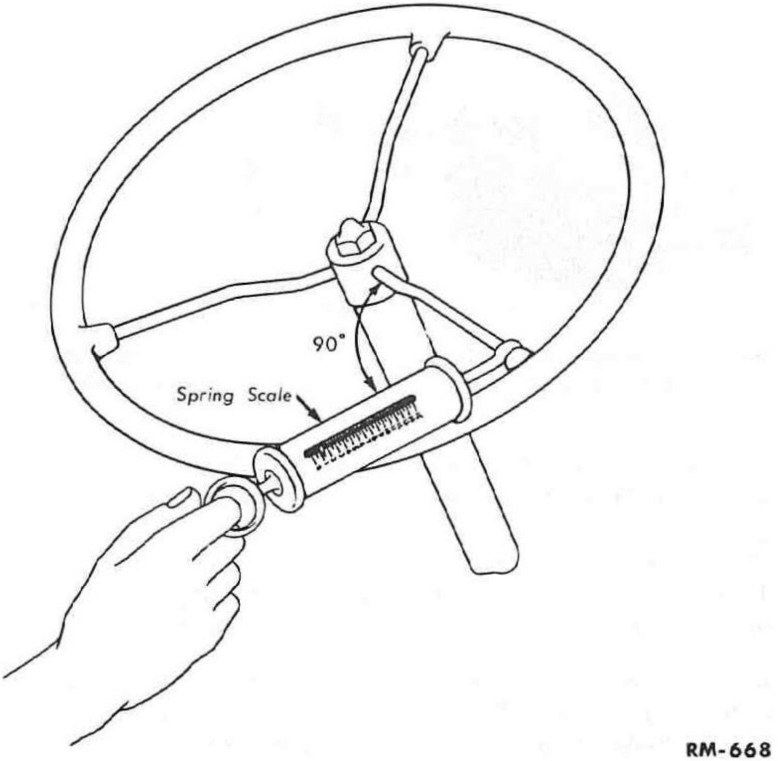

Fig. 7—Checking Steering Adjustment

Hold the ball nut in your hand and rotate the steering shaft until the center tooth (2 teeth each side) lines up with the center of the left sector shaft opening.

Place the left sector shaft (3 large and 4 small teeth) and thrust washer in the sector shaft bearing housing, and position the metal gasket on the housing. Install this assembly in the steering gear housing with the center tooth of the three large sector teeth meshed in the center space of the teeth on the ball nut. While engaging the left sector shaft and ball nut, it may be necessary to hold the ball nut in position by reaching through the hole in the right side of the steering gear housing. The bearing is eccentric in the sector shaft bearing housing and should be installed with the notch located at the bottom.

Rotate the left housing counterclockwise (as viewed from the left side of the tractor) to eliminate backlash. Secure the sector shaft bearing housing by installing the washer and four cap screws. The adjustment between the left sector and ball nut should be such that

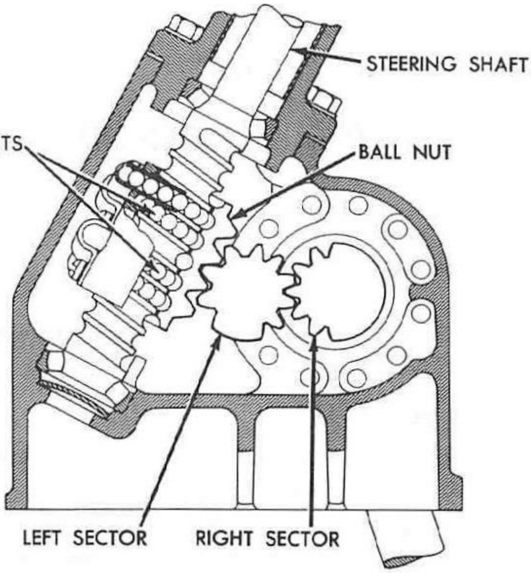

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Fig. 8—Timing Sector Shaft and Ball Nut

a pull of 2 to 3 pounds is required to turn the steering wheel through the straight ahead position (fig. 7).

Place the right sector shaft and thrust washer in the sector shaft bearing housing, and position the metal gasket on the housing. The right sector must be engaged with its center tooth meshed in the third tooth space on the left sector gear, counting from the solid section of the gear, located on the bottom, as shown in fig. 8. The tooth on the right sector can be identified by a dot or mark on the end of the tooth.

The tooth space on the left sector also can be identified by a dot or mark. The bearing is eccentric in the sector shaft bearing housing and should be installed with the notch located at the bottom. Rotate the housing clockwise (as viewed from the right side of the tractor) to reduce backlash.

The adjustment between the right and left sector should be such that the force required to turn the steering wheel through the straight ahead position is 3 to 6 pounds.

The steering gear assembly should be filled with S.A.E. 90 oil. This oil may be pumped into the right side of the steering gear housing through the pipe plug hole.

Chapter
III
TRANSMISSION

Section
Disassembly 131
Inspection and Repair 132
Assembly 133

The Model 8N Ford tractor is equipped with a four-forward speed, constant-mesh transmission.

131. DISASSEMBLY.

The transmission comprises seven principle subassemblies. These should be removed as follows.

a. Remove Subassemblies. Remove the cover assembly. Remove the top shift rail and plates by loosening the nut on the shift fork and turning out the screw until the shaft is free to slide on the fork. Slide the shift rail out of the rear of the housing. The interlock spring and ball will fall from the top of the housing as the rail is removed. Remove the large shift pivot screws from each outside face of the housing, and remove the shift plates.

Disconnect the clutch release bearing retaining springs, and remove the bearing.

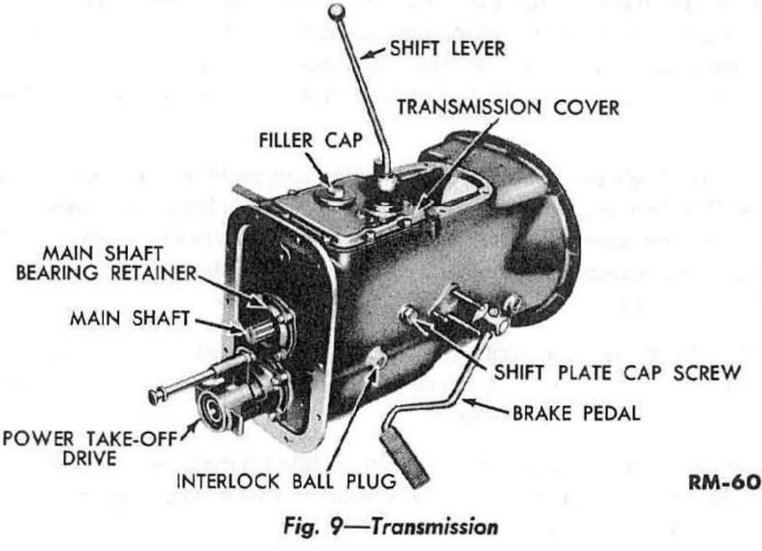


Fig. 9—Transmission

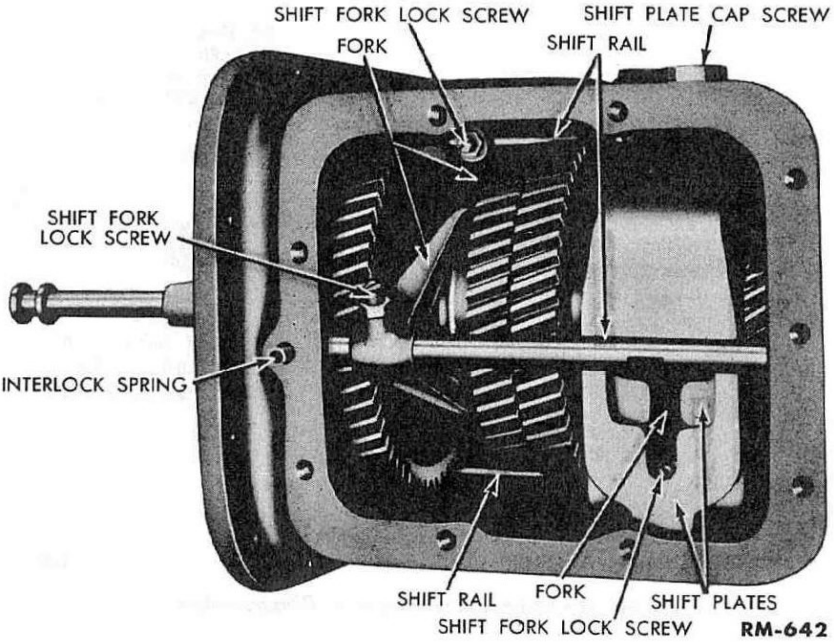


Fig. 10—Transmission With Cover Removed

To remove the main drive gear bearing retainer assembly, hold the shaft and retainer together, and remove the retainer and gear as a unit.

Remove the main shaft bearing retainer assembly, being sure that the metal shim pack is carefully identified as a unit. This will facilitate adjustment after assembly.

Remove the main shaft gear cluster as a unit. This should be accomplished slowly so as to avoid damaging the gear teeth.

Remove the two lower shift rails by removing the interlock screw plug, spring, and ball from each side of the housing. Loosen the nuts on the shift forks and turn out the screw until the shafts are free to slide on the forks. Slide the shift rails out of the rear of the housing.

Remove the power take-off shift assembly. Keep the metal shim pack carefully identified as a unit. This will facilitate adjustment after assembly.

Remove the countershaft gear cluster as a unit. Be careful not to damage the gear teeth.

Remove the reverse idler assembly. Tap the forward end of the shaft to remove it and the horseshoe-type retaining washer from the

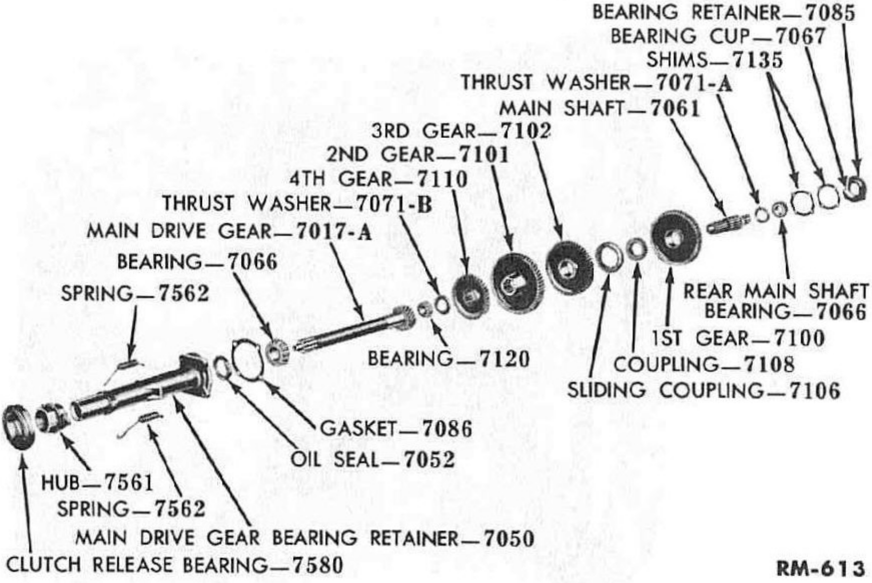


Fig. 11—Main Shaft Assembly, Disassembled

rear end of the transmission. Be sure that the gear teeth are not damaged.

b. Disassemble Subassemblies. The subassemblies of the transmission comprise the main shaft assembly, countershaft assembly, reverse idler assembly, power take-off shift assembly, clutch release bearing assembly, main drive gear bearing retainer assembly, and the transmission housing. Only the first four mentioned will be discussed here, as the disassembly of the remainder is obvious after their removal.

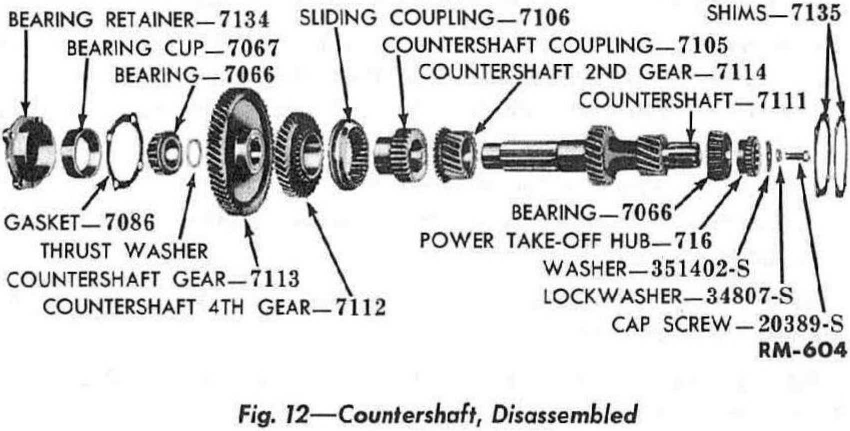


Fig. 12—Countershaft, Disassembled

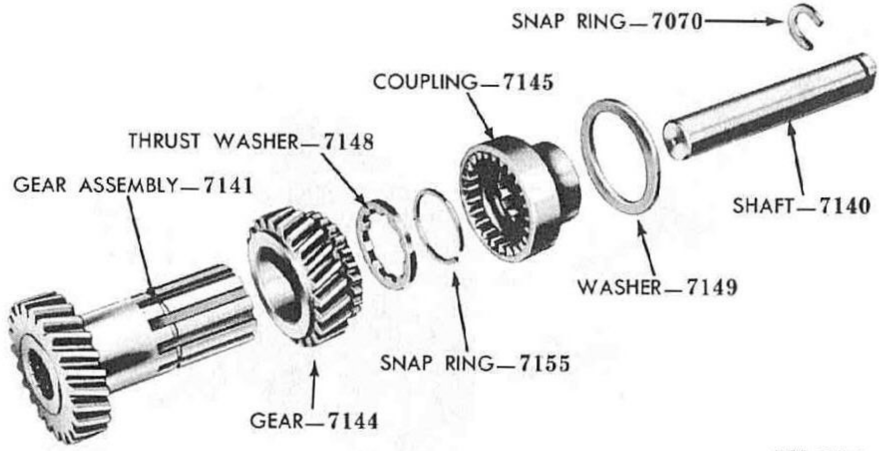


Fig. 13—Reverse Idler Gear, Disassembled

(1) *MAIN SHAFT ASSEMBLY.* Remove the bearing from the forward end of the main shaft (fig. 11). To remove the rear main shaft bearing, install a bearing puller on the 60T gear, and remove the gear, thrust washer, and bearing. Remove the rest of the gears from the shaft. Remove the forward roller bearing and the 20T main drive gear with a bearing puller.

(2) *COUNTERSHAFT ASSEMBLY.* Remove the rear roller bearing (fig. 12) with a bearing puller. Press the countershaft gear

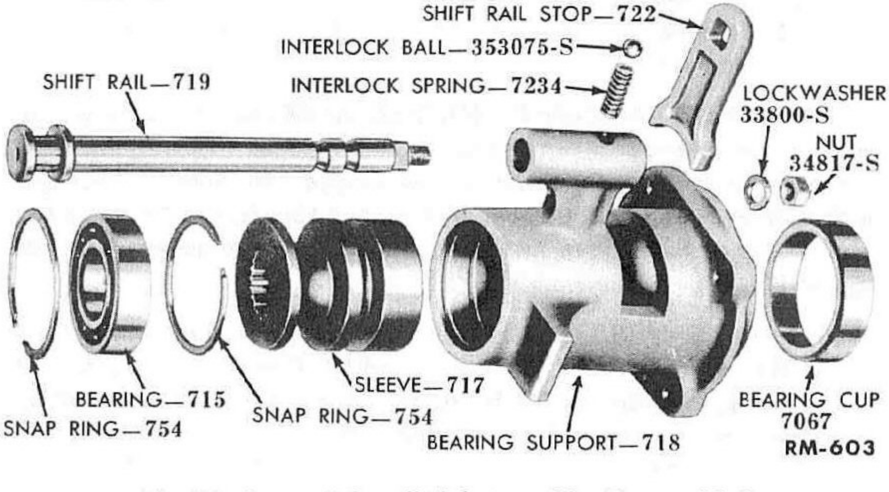


Fig. 14—Power Take-off Shift Assembly, Disassembled

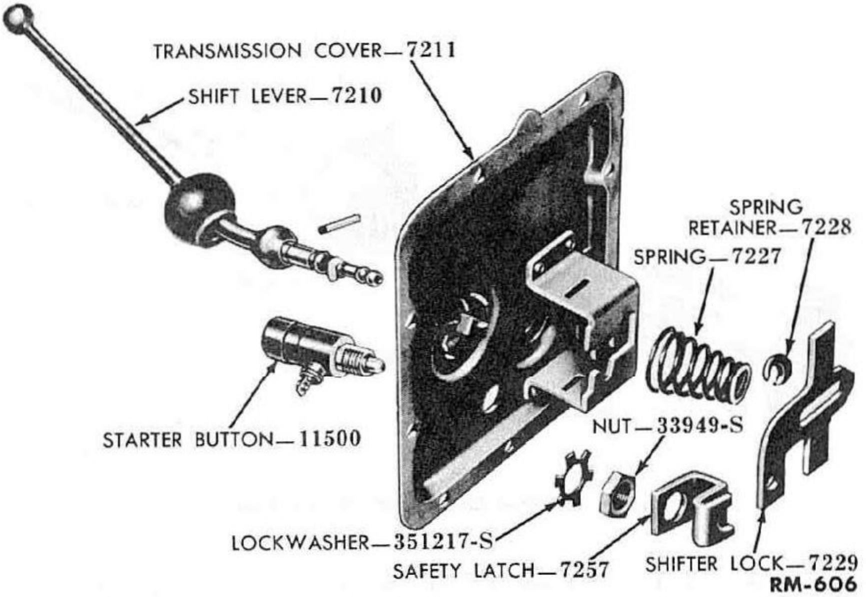


Fig. 15—Transmission Cover, Disassembled

(55T) and roller bearing off the countershaft. Lift the countershaft fourth gear (36T) and sliding coupling from the countershaft (fig. 12). Remove the countershaft coupling from the countershaft with a gear puller or press. Lift the countershaft second gear (18T) from the shaft.

(3) *REVERSE IDLER GEAR ASSEMBLY.* Remove the reverse gear coupling from the reverse idler gear and bushing assembly (fig. 13). Remove the snap ring, thrust washer, and reverse idler gear and bushing assembly.

(4) *POWER TAKE-OFF SHIFTER ASSEMBLY.* Remove the snap ring from the rear of the bearing support (fig. 14). Lift the bearing and clutch sleeve from the bearing support. Remove the nut and lock washer from the shift rail, and remove the shift rail toward the rear, being careful not to lose the interlock ball and spring. Lift out the shift fork.

(5) *TRANSMISSION COVER.* Slide the shift lever rubber boot up on the lever. Remove the starter switch. Compress the gearshift lever spring, and remove the horseshoe-type spring retainer. Pull up on the gearshift lever and, by turning it 90°, lift it out of the assembly. Tilt the safety latch plate and remove it from the guide support (fig. 15). Drive the pin from the gearshift lever, and lift off the lever.

132. INSPECTION AND REPAIR.

Inspection of the transmission must cover the following 9 items.

a. **Gears.** Replace all gears which have broken or chipped teeth or broken splines. Replace gears that rotate on a shaft and the inside diameter is excessively worn.

b. **Shafts.** Replace a shaft that has broken or damaged splines or teeth. Replace a shaft if the bearing surface is scored or excessively worn.

c. **Bearings.** Replace a bearing if it is scored or pitted or if any rollers are missing.

d. **Bearing Cups.** Replace any bearing cups that are scored or pitted.

e. **Thrust Washers.** Replace cracked or broken thrust washers.

f. **Bearing Retainers.** Replace cracked or damaged bearing retainers.

g. **Shift Forks.** Replace damaged or broken shift forks or one on which the threads are stripped.

h. **Shift Lever.** Replace a damaged shift lever.

i. **Transmission Cover.** Replace the transmission cover if it is damaged or if the bracket rivets are loose.

133. ASSEMBLY.

Assembly of the transmission includes the assembly of the subassemblies and of the transmission itself. Make sure that all parts are in a serviceable condition before assembly.

a. **Main Shaft Assembly.** To assemble the main shaft, press the rear thrust washer and bearing on the shaft (fig. 11). Install the first gear (60T) on the shaft with the coupling teeth facing toward the front of the shaft. Install the coupling and sliding coupling on the shaft. Install the third gear (52T) on the shaft with the coupling teeth facing toward the coupling. Install the second (56T) and fourth gears (39T) on the shaft with the long end of the hubs touching each other. Install the thrust washer and bearing on the shaft.

b. **Countershaft Assembly.** Press the bearing on the rear of the shaft (fig. 12). Install the power take-off hub, flat washer, lock washer, and cap screw. Install the countershaft second gear (18T) on the shaft, with the coupling teeth facing toward the front of the shaft. Press the countershaft coupling on the shaft with the sleeve end facing toward the front of the shaft. Install the sliding coupling. Install the fourth gear (36T) on the coupling sleeve with the coupling teeth on the gear facing towards the rear of the shaft. Press the countershaft gear (55T) on the shaft with the long end of the hub facing towards the rear of the shaft. Press the bearing on the shaft.

c. Reverse Idler Assembly. Install the reverse idler driven gear (23T) on the reverse idler gear (23T) and bushing assembly with the coupling teeth facing the end of the hub (fig. 13). Install the thrust washer and snap ring on the reverse idler gear and bushing assembly. Install the reverse gear coupling on the reverse idler driven gear sleeve with the coupling teeth facing the coupling teeth on the driven gear.

d. Power Take-off Shifter Assembly. Install the snap ring (fig. 14) in the bearing support. Install the clutch sleeve in the bearing support with the large end of the sleeve facing toward the bearing cup end of the bearing support. Install the bearing and snap ring in the bearing support. Install the interlock spring and ball. Depress the interlock ball, then push the shift rail into the bearing support until the threads on the rail are flush with the bearing support. Hold the shift rail stop in position in the bearing support and push the shift rail into the shift rail stop. Install the nut and lock washer on the shift rail.

e. Transmission Cover. If the shift lever has been removed, reinstall it, securing with a lever pin. This pin should be installed with an arbor press or bench vise. Install the safety latch plate. Place spring (7227) in position as shown in fig. 15. Slide the gearshift lever through the spring and safety latch plate and turn it 90 degrees until the pin is properly seated in the slot in the bottom of the cover. Compress the spring and install the spring retainer (7228). Position a new gasket on the starter switch and install the switch in the cover. Place the starter latch support over the threaded end of the switch and secure with a tabbed lockwasher and nut. Turn one of the tabs of the washer against the nut and secure the nut in place.

f. Single Transmission. Before assembling the transmission make sure that all assemblies are clean and dry. Oil is not to be added until after the bearing tension has been adjusted.

Install the reverse idler assembly in the housing with the gears facing toward the front. Hold a spacer washer between the coupling and the housing and install the reverse idler shaft and lock ring. Position the countershaft assembly in the transmission housing with the large gear at the front of the housing. Install the countershaft front bearing retainer and gasket. Hold the countershaft in position and install the power take-off shift assembly together with the shim pack which was previously removed and identified. Install the power take-off shaft in the shift assembly. Measure the torque necessary to turn the power take-off shaft. It should be from 15 to 30 pounds-inches. Add or remove shims as required to obtain this torque reading. Removing

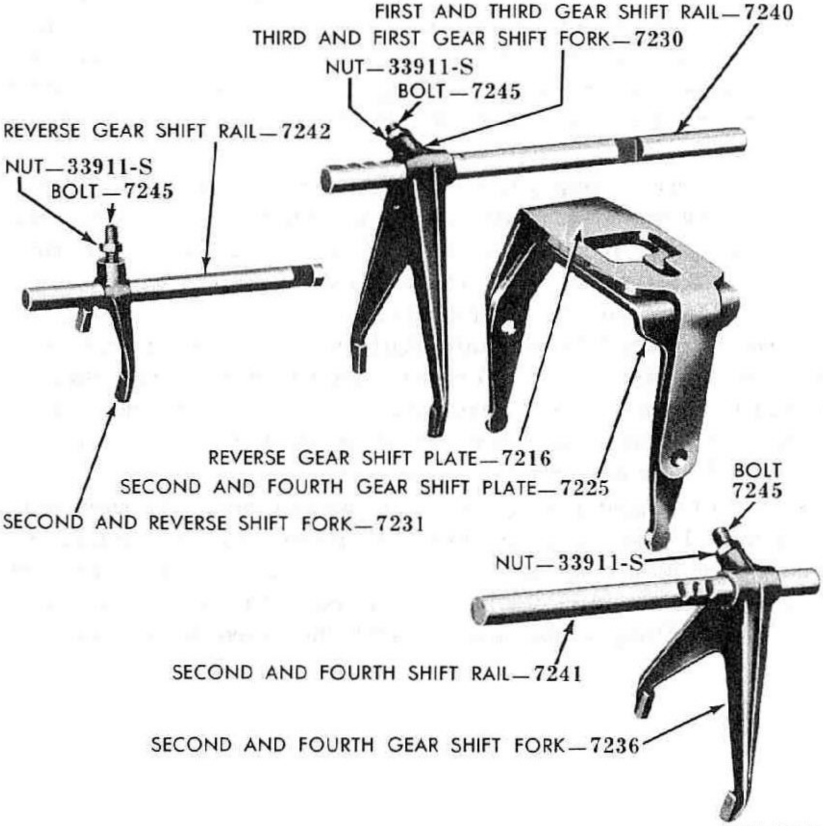

FIRST AND THIRD GEAR SHIFT RAIL—7240
THIRD AND FIRST GEAR SHIFT FORK—7230
NUT—33911-S
BOLT—7245
REVERSE GEAR SHIFT RAIL—7242
NUT—33911-S
BOLT—7245
REVERSE GEAR SHIFT PLATE—7216
SECOND AND FOURTH GEAR SHIFT PLATE—7225
SECOND AND REVERSE SHIFT FORK—7231
BOLT 7245
NUT—33911-S
SECOND AND FOURTH SHIFT RAIL—7241
SECOND AND FOURTH GEAR SHIFT FORK—7236
RM-615

Fig. 16—Shift Rails and Shift Forks

one 0.005 inch shim will increase the torque approximately 10 pounds-inches. Adding a 0.005 inch shim will decrease the torque a like amount.

Install the two lower shift rails and shift forks making sure that the deep square cornered slots face inward on both rails. Install the interlock ball spring and nut on each side of the housing. Install the main shaft assembly being careful not to damage the gear teeth. Install the rear main shaft bearing retainer assembly, using the metal shim pack previously removed and identified. Install the main drive gear bearing retainer assembly and gasket. Position all shift rails and forks in the neutral position and measure the torque required to turn the main shaft. Several turns should be completed so that the bearings will be properly seated. After the shift is turning uniformly, the torque should be from 20 to 35 pounds-inches. Add or remove shims as required to obtain this torque reading. Removing one 0.005 inch shim will increase the torque approximately 10 pounds-inches. Adding a 0.005 inch shim will decrease the torque a like amount. Main shaft shims can be changed by supporting the rear main shaft bearing retainer over the power take-off shift shaft and sliding the shims in or out.

If it has been necessary to replace any of the transmission gears, a careful check should be made to make sure that all gears mesh properly. Install the power take-off shaft in the power take-off shift assembly. Engage the power take-off shaft with the transmission. Position the transmission in neutral and measure the torque required to turn the power take-off shaft. With the shaft turning uniformly, the torque should be from 30 to 60 pounds-inches. If more than 60 pounds-inches of torque are required to turn the shaft, one or more of the gears are binding at the teeth or on the hub shoulders. Determine which gear is binding and replace it.

Position the shift plates in the housing and install the shift plate cap screws. Install the upper shift fork and shift rail, positioning the deep square corner slot in the rail toward the opening in the shift plates. Install the interlock ball and spring in the hole at the top of the housing. Using a new gasket, install the transmission cover.

Chapter

IV

HYDRAULIC SYSTEM

Section
Hydraulic Unit 141
Hydraulic Pump 142
Hydraulic System Adjustments 143

141. HYDRAULIC UNIT.

This section gives instructions for the disassembly, inspection and repair, and assembly of the hydraulic unit.

a. Disassembly. The hydraulic unit may be disassembled by subassemblies.

(1) *REMOVE RAM CYLINDER.* To remove the hydraulic ram cylinder, it is necessary to remove the four bolts that mount it on the hydraulic unit cover (fig. 17). Lift the ram cylinder off the assembly. If desired, the piston rod may be removed by disconnecting it from the ram arm.

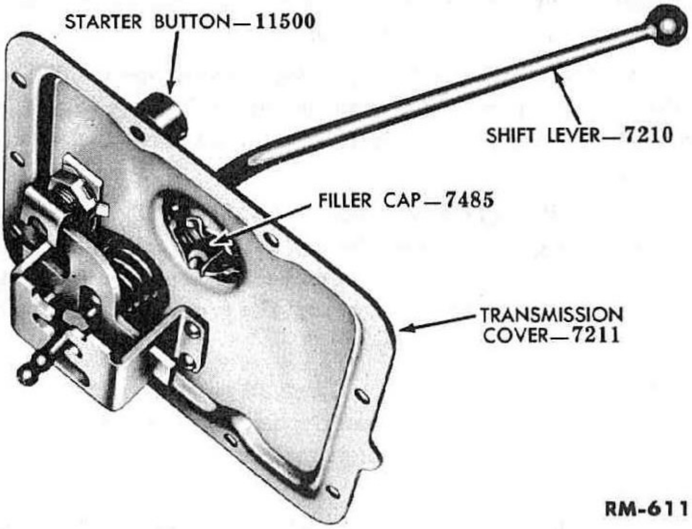


Fig. 17—Hydraulic Unit Assembly

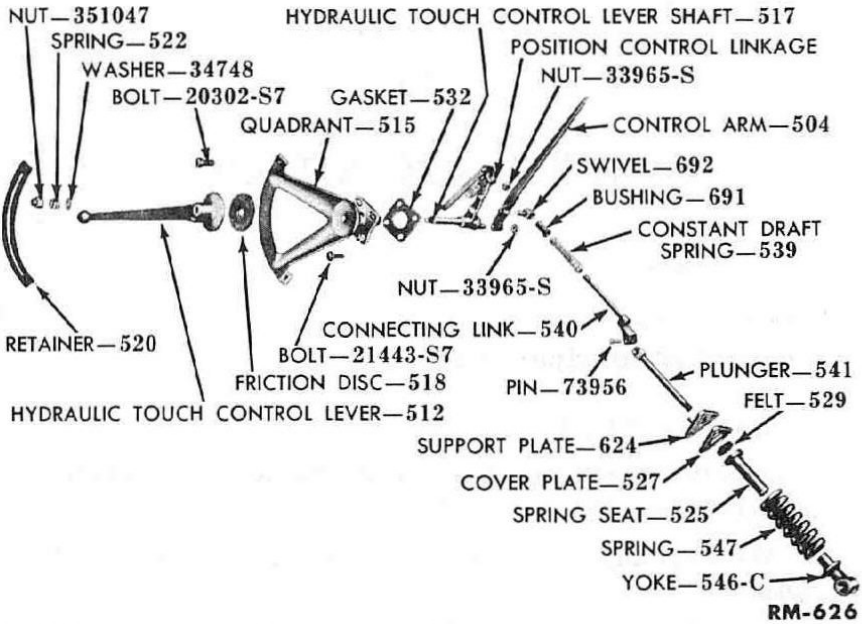


Fig. 18—Hydraulic Control Linkage

(2) *REMOVE CONTROL LINKAGE.* Remove the hydraulic touch control lever retainer (fig. 18) from the quadrant. Remove the nut, spring and flat washer that secure the hydraulic touch control lever shaft. Remove the hydraulic touch control lever, woodruff key, and the friction disk from the shaft.

Remove the cotter pin that attaches the linkage which secures the position control lever to the position control linkage (figs. 17 and 18). Remove the control arm, draft control linkage, and position control linkage.

(3) *REMOVE LIFT ARMS AND SHAFT.* Remove the two cap screws, lock washer, and the flat washer from each arm. Remove the lift arms from the shaft. Remove the shaft from the hydraulic unit cover. Remove the ram arm and the remaining bushing from the hydraulic unit cover (fig. 19).

b. Inspection and Repair. Clean all parts thoroughly in cleaning fluid. Scrape off any incrustated deposits on the cover or parts. It is very important that any foreign matter that might get into the oil be removed.

(1) *COVER.* Replace the cover if it is cracked or damaged in any way.

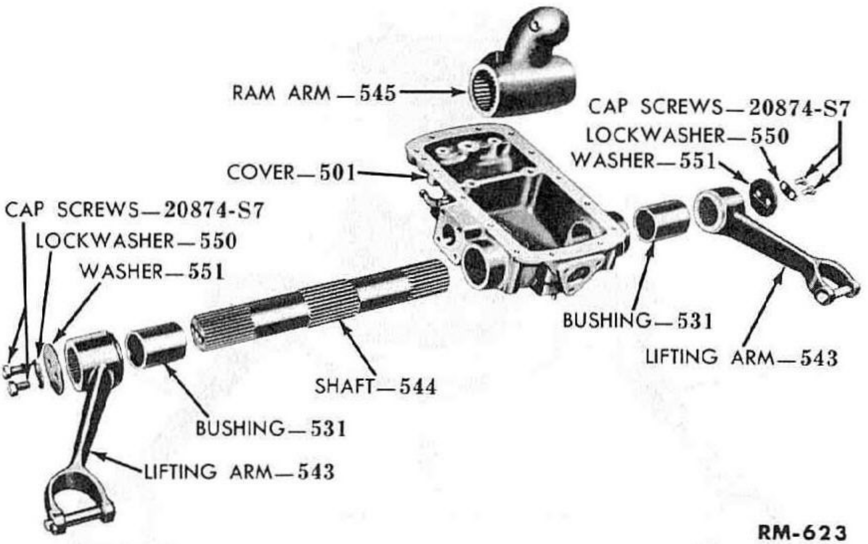


Fig. 19—Hydraulic Cover and Lift Arms, Disassembled

(2) *BUSHINGS*. Replace the lifting arm shaft bushings if they are scored, pitted, or if the inside diameter is excessively worn.

(3) *LIFTING ARM SHAFT*. Replace the lifting arm shaft if it is damaged or if the bearing surface is excessively worn.

(4) *LINKAGE*. Replace any linkage that is twisted, bent, or damaged in any way.

(5) *RAM CYLINDER AND PISTON*. Replace the ram cylinder (fig. 20) if it is scored or if the bore is excessively worn. Replace the piston rings when the cylinder is disassembled. Replace the piston if it is scored or cracked.

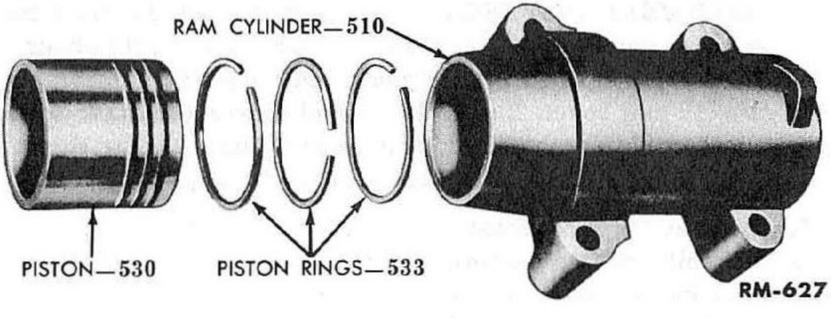


Fig. 20—Ram Cylinder, Disassembled

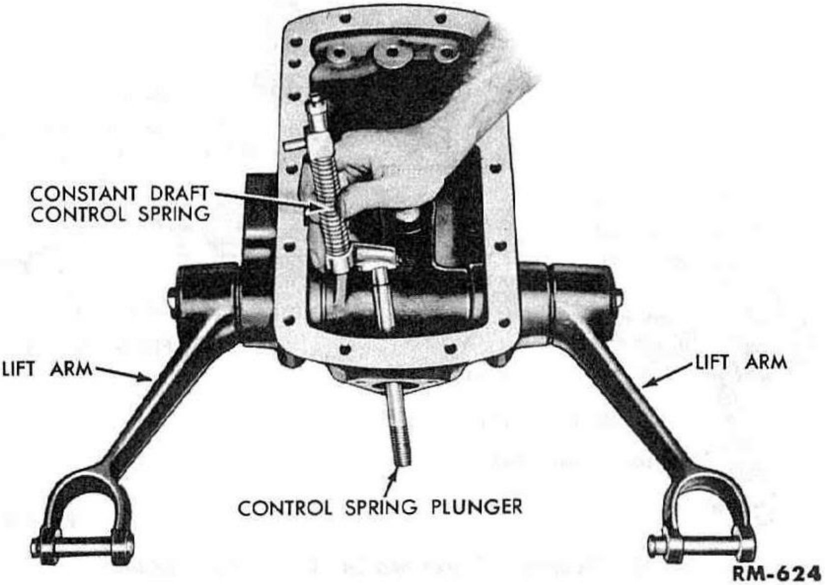


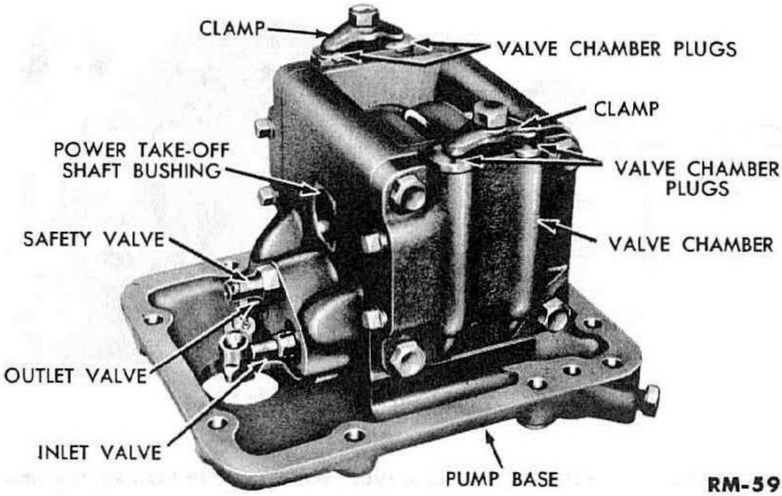
Fig. 21—Install Constant Draft Control Linkage

c. **Assembly.** The hydraulic unit may be assembled by subassemblies. The sequence of assembling subassemblies onto the hydraulic unit cover may be changed from that given below.

(1) *ASSEMBLE LIFT ARMS AND SHAFT*. Hold the ram arm in place in the hydraulic unit cover, and install the shaft. Install the two bushings (fig. 20) on the shaft. Install the two lift arms on the shaft, and secure each arm to the shaft with a flat washer, lock washer, and two cap screws. The lift arms should be tightened enough to prevent end play of the shaft. The lift arms should not bind to the extent that they will not settle under their own weight.

(2) *ASSEMBLE CONTROL LINKAGE*. Install the draft control linkage as shown in fig. 21. Place the position control linkage on the hydraulic touch control lever shaft, and insert this assembly in the hydraulic unit cover. Install the control arm on the draft control linkage and the hydraulic touch control lever shaft. Secure the control arm in place with a castellated nut and cotter pin.

Position the three-cornered plate with the pin at the top on the hydraulic unit cover and secure with three cap screws. Install a new felt washer in the control spring seat. Install the control spring seat, control spring, and yoke (fig. 18). Mount the quadrant, using a new gasket, on the hydraulic unit cover. Install a new friction disk and



RM-599

Fig. 22—Hydraulic Pump

woodruff key on the hydraulic touch control lever shaft. Install the hydraulic touch control lever on the shaft making sure that it slides freely on the woodruff key, and secure it in place with a flat washer, spring, and nut. If the woodruff key fits too tightly in the touch control lever and therefore cannot slide freely, the spring which maintains a constant pressure on the friction disk will be ineffective. Install the hydraulic touch control lever retainer. Connect the position control lever to the position control linkage.

(3) *ASSEMBLE RAM CYLINDER AND PISTON.* Assemble the rings onto the ram cylinder piston and equally space the ring gaps around the piston. Install the piston in the ram cylinder. Using new gaskets (three required) bolt the ram cylinder to the hydraulic unit cover. Install the piston rod.

142. HYDRAULIC PUMP.

The disassembled hydraulic pump is shown in fig. 22.

a. Disassembly. Remove the safety valve and check valve. Remove the cotter pin which secures the valve control lever to the base. Remove the cotter pin and clevis pin which secure the exhaust valve to the control lever. Remove the control lever. Remove the four cap screws which secure each valve chamber cover (fig. 22) to the base. With a soft hammer, tap the valve chambers off the base. Lift the cam and piston assembly out of the base. Remove the power take-off shaft bushing (figs. 22 and 26) from the base. Remove the

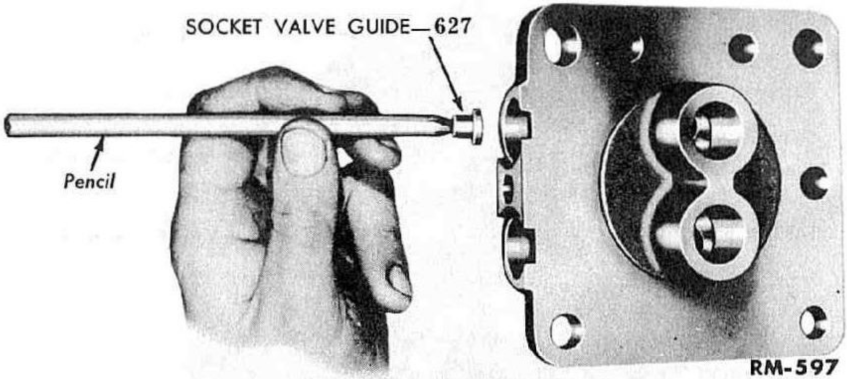


Fig. 23—Removing Valve Guide Seats

clamp from each valve chamber cover. Remove the two spring seats, outlet valve springs, outlet valves, inlet valve springs, inlet valves, valve guides, and valve guide seats from each valve chamber (fig. 27). Remove the two valve guide seats from each valve chamber cover with a pencil as shown in fig. 23.

b. Inspection and Repair. Clean all parts thoroughly in a cleaning solvent and blow dry with compressed air. Scrape gasket surfaces until all pieces of old gasket are removed.

(1) *SAFETY VALVE.* Replace the safety valve (fig. 24) if the check valve surface is ridged, if the ball is worn or damaged, or if the safety valve spring has taken a permanent set as shown by inability to hold the required pressure.

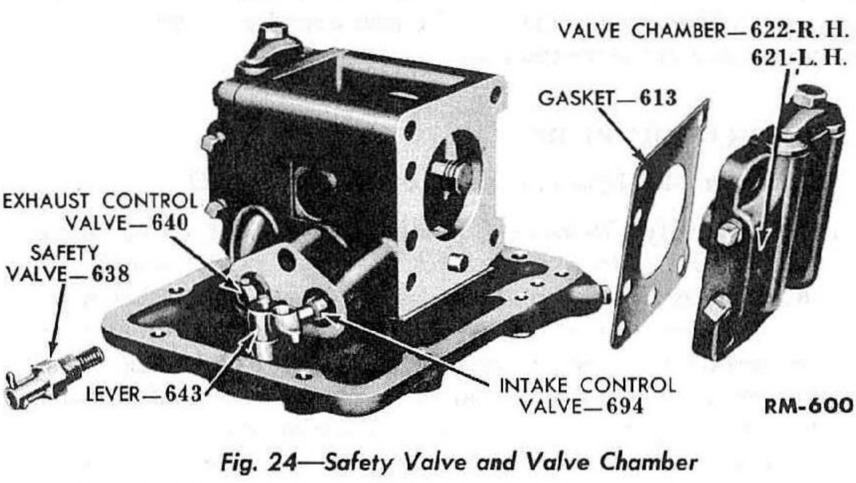


Fig. 24—Safety Valve and Valve Chamber

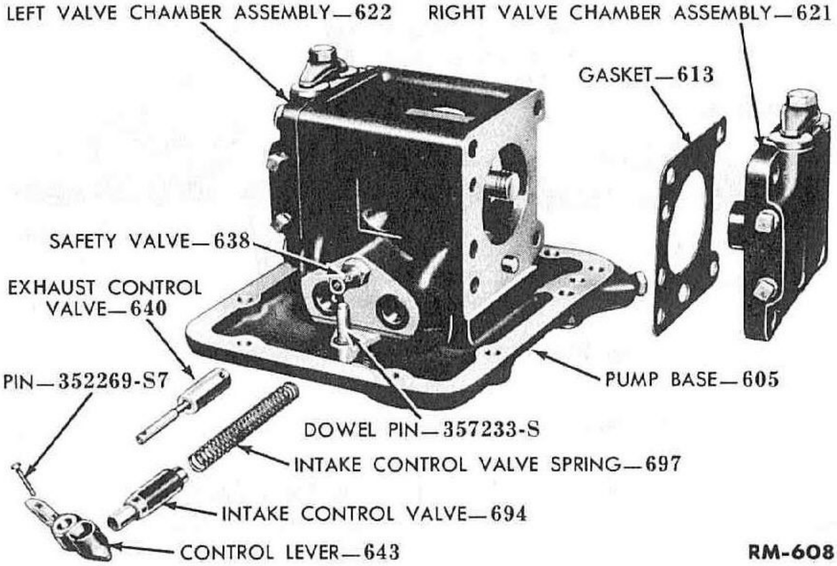

LEFT VALVE CHAMBER ASSEMBLY—622
RIGHT VALVE CHAMBER ASSEMBLY—621
GASKET—613
SAFETY VALVE—638
EXHAUST CONTROL VALVE—640
PIN—352269-S7
PUMP BASE—605
DOWEL PIN—357233-S
INTAKE CONTROL VALVE SPRING—697
INTAKE CONTROL VALVE—694
CONTROL LEVER—643
RM-608

Fig. 25—Control Valves, Disassembled

(2) *INTAKE AND EXHAUST CONTROL VALVES.* Replace the intake or exhaust valve if they are scored, or if the spring in the outlet valve is broken. Replace the intake or exhaust control valve bushings (subpar. (a) below) if they are scored. It is important that the intake and exhaust control valves work freely in the bushings.

(*a*) Control Valve Bushing Replacement. Drive the bushing out of the pump base. Press the new bushing into the pump base with a suitable pressure device equipped with a pilot, until it is perfectly flush with the machined surface on the base.

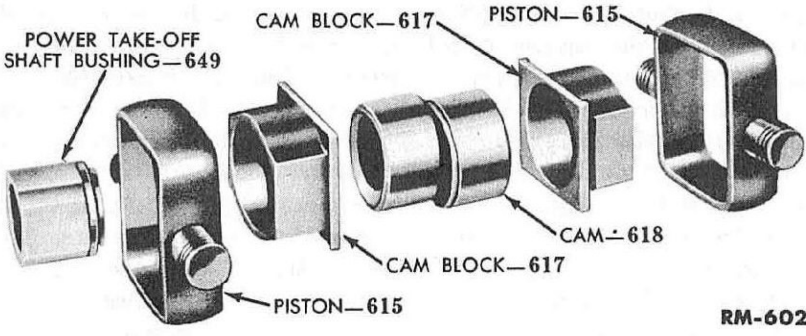


Fig. 26—Cam Blocks and Pistons, Disassembled

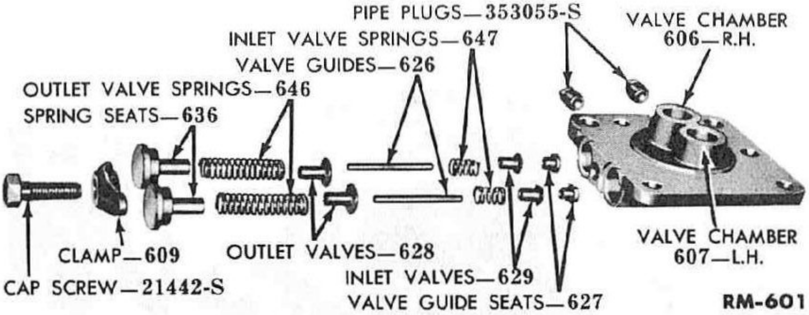


Fig. 27—Valve Chamber, Disassembled

(3) *PISTON*. Replace a piston (fig. 26) that is scored at any machined surface.

(4) *CAM, CAM BLOCK, AND POWER TAKE-OFF BUSHING*. Replace a cam, cam block, or power take-off bushing (fig. 26) if they are scored.

(5) *VALVE CHAMBER*. Replace a valve chamber (fig. 24) if it is cracked or if the inlet valve or outlet valve seats are rough or pitted.

(6) *PUMP BASE*. Replace the base (fig. 22) if it is cracked, if the gasket surface is nicked or damaged, or if any threads are stripped.

c. Assembly. Lubricate all parts before assembly. Install the exhaust control valve (fig. 27) in the exhaust control valve bushing. Install the intake control valve, spring, washer, and spring retainer in the bushing. Hold the intake control valve in the bushing, and install the valve control lever (fig. 27). Connect the exhaust control valve to the control lever with a clevis pin and cotter pin. Secure the control lever to the cover with a cotter pin. Install the safety valve assembly (fig. 24) on the pump base. Install the valve guide socket, valve guide, inlet valve, inlet valve spring, outlet valve, outlet valve spring, and valve chamber plug as shown in fig. 27. Secure the valve assembly in place with the top clamp and cap screw. This procedure applies to both the left and right valve chambers. Install the cam block on the cam as shown in fig. 26. Install a piston on each cam block, making sure that the narrow parts of the offset on each piston are together when the pistons are installed on the cam blocks. After the pistons are assembled on the cam block, the pistons may be fitted to the cylinders in a valve chamber to be sure that the pistons have been assembled correctly on the cam block. Install the power take-off bushing in the pump base. The shoulder on the power take-off bushing must be installed toward the pump piston assembly. Position the pistons, cam block, and cam assembly in the pump base,

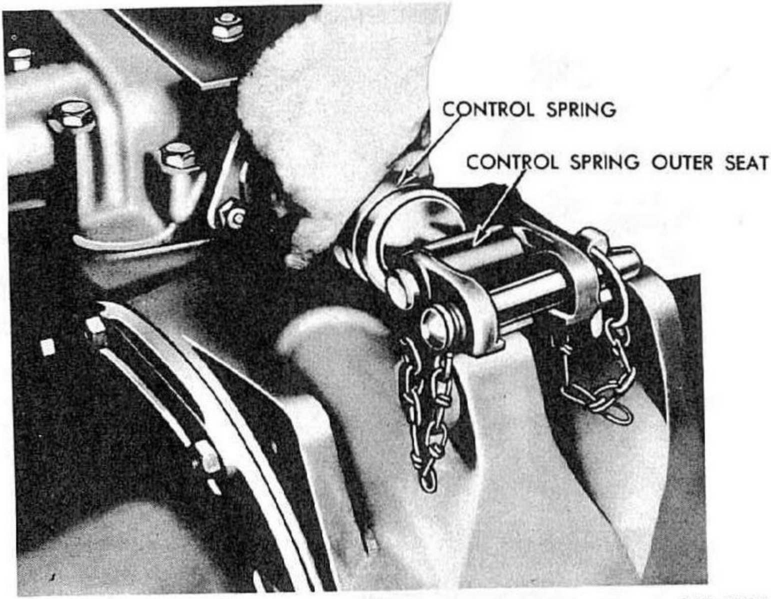


Fig. 28—Control Spring Adjustment

making sure that the shoulder on the power take-off bushing is seated in the recess in the forward end of the cam. Install the valve chambers and new gaskets on the pump base. When installing the valve chambers, be sure that the oil holes in the valve chamber are in line with the oil passages in the pump base. There are right and left hand valve chambers and it is possible to interchange them. The pipe plugs should be on the same end of the pump as the control valves (fig.22).

143. HYDRAULIC SYSTEM ADJUSTMENTS.

The hydraulic pump is of precision manufacture and does not require adjustment. The hydraulic unit, however, is composed of several subassemblies and must be carefully adjusted as outlined below.

a. External Adjustments. There are two external adjustments of the hydraulic unit. They may be made with the hydraulic unit either on or off the tractor.

(1) *ADJUSTMENT OF CONTROL SPRING*. Place the hydraulic touch control lever at the top of the quadrant, then turn the outer control spring seat until there is no end play in the spring. The preload on the control spring should be such that it is possible to turn the spring with a thumb and two finger grip as shown in fig. 28.

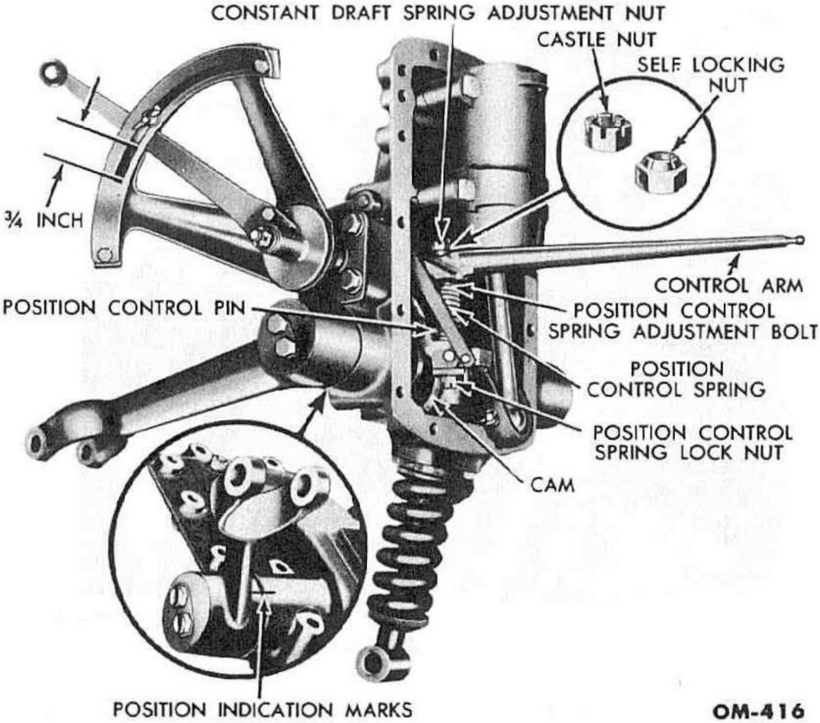

CONSTANT DRAFT SPRING ADJUSTMENT NUT
CASTLE NUT
SELF LOCKING NUT
¾ INCH
CONTROL ARM
POSITION CONTROL PIN
POSITION CONTROL SPRING ADJUSTMENT BOLT
POSITION CONTROL SPRING
POSITION CONTROL SPRING LOCK NUT
CAM
POSITION INDICATION MARKS
OM-416

Fig. 29—Hydraulic Unit in Position for Adjustments

(2) *ADJUSTMENT OF FORCE REQUIRED TO MOVE HYDRAULIC TOUCH CONTROL LEVER.* This is accomplished by tightening or loosening the nut on the end of the hydraulic touch control lever shaft (fig. 17). Tightening the nut increases the force required to move the lever. It should be set so that it requires a pull of 4 to 5 pounds on the knob to move the lever.

b. Internal Adjustments. The internal adjustments have been carefully made at the factory. However, it may be necessary to readjust the hydraulic unit after an overhaul. These internal adjustments must be made before the unit is installed on the tractor.

The first step in making the internal adjustments is to check the two external adjustments as outlined above, and adjust if necessary.

(1) Support the unit in a vise in a vertical position with the control spring down as shown in fig. 29.

The lift arms must be supported in the fully raised position as indicated by the marks on the lift arms and housing (fig. 29).

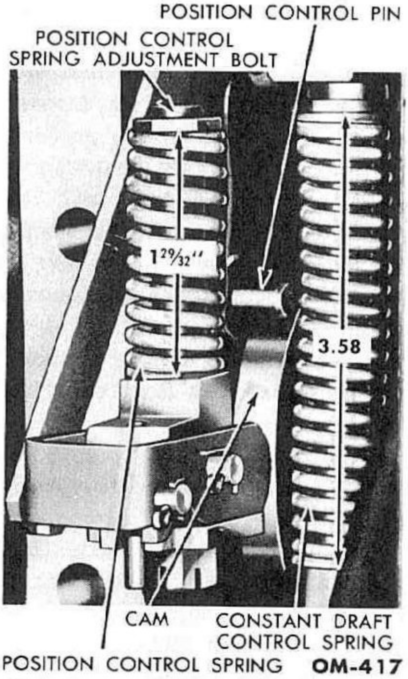

POSITION CONTROL PIN
POSITION CONTROL SPRING ADJUSTMENT BOLT
1 29/32"
3.58
CAM
CONSTANT DRAFT CONTROL SPRING
POSITION CONTROL SPRING
OM-417

Fig. 30—Constant Draft Control and Piston Control Springs

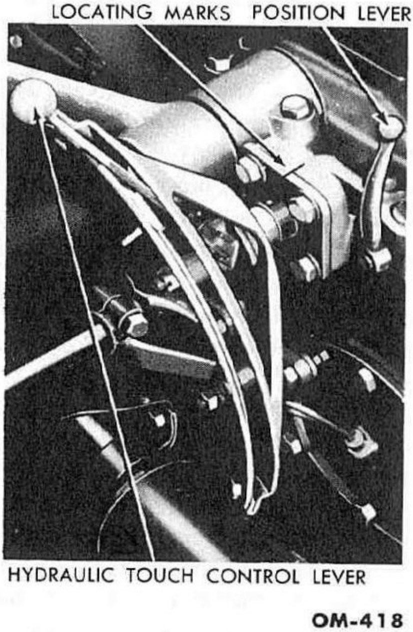


Fig. 31—Quadrant Locking Mark

(2) Examine the constant draft spring adjustment nut (fig. 29). If it is a lock nut, it should be tightened until the washer bears against the shoulder. If it is a standard castellated nut with a cotter pin, the nut should be adjusted to give the correct length of the constant draft spring, then the cotter pin can be installed. The constant draft spring should be 3.58 inches long (slightly over $3\frac{9}{16}$ inches is satisfactory) as shown in fig. 30.

(3) Examine the top of the quadrant support plate for locating marks as shown in fig. 31. The quadrant support cap screws should be loosened, locating marks aligned, and the cap screws tightened. If there are no locating marks, remove two cap screws from the quadrant support plate, loosen the two remaining cap screws, and center the slot in the quadrant support plate on the cap screws as accurately as possible. Replace and tighten the cap screws that support the quadrant.

(4) Place the position control lever in the position shown in fig. 29. Move the hydraulic touch control lever until there is an opening

of ¾ inch between the edge of the lever and the top end of the slot in the quadrant as shown in fig. 29.

(5) Make sure that the control arm moves freely and is held in a horizontal position by its own weight as shown in fig. 29. Loosen the position control lock nut, and adjust the length of the position control spring by turning the position control spring adjustment bolt (fig. 30). Adjust the position control spring length until the position control pin contacts the cam, and the position control spring adjustment bolt contacts the control arm, as shown in fig. 29. It will probably be necessary to hold the position control pin in contact with the cam. The position control spring length should be 1 29/32 inches plus or minus 1/16 inch after the adjustment has been made (fig. 30). Tighten the position control spring lock nut after completing the adjustment.

After the above adjustments have been made, check the position of the hydraulic touch control lever and lift arms to be sure they were not moved while making the adjustments.

(6) Install the hydraulic unit on the tractor, making sure that the end of the control arm enters the opening in the valve control lever and that the control arm is not bent or damaged in any way during this operation. Do not install the inspection plate.

(7) Place the position control lever in the forward position, support the lower links near the raised position, and place the hydraulic touch control lever at the top of the quadrant. Check the position and operation of the intake control valve as follows:

(*a*) POSITION OF VALVE. The valve should be completely open when the hydraulic touch control lever is at the top of the quadrant. The valve is open when, by inserting the hand in the inspection opening, it is impossible to press the end of the control valve arm toward the pump face any farther.

(*b*) OPERATION OF VALVE. Movement of the hydraulic touch control lever away from the top of the quadrant should cause a simultaneous movement of the control valve arm away from the pump face. Movement of the control valve arm should begin at the start of movement of the hydraulic touch control lever.

There is only one position in which the quadrant support plate can be located where both of the above conditions will be met. To find this position, slightly loosen the four cap screws that support the quadrant. Hold the hydraulic touch control lever at the top of the quadrant and gently tap the quadrant support plate forward or backward until both of the above requirements are fulfilled.

(8) Tighten the four quadrant support cap screws securely and install the inspection plate on the center housing.

Chapter

V

REAR AXLE

Section
Disassembly 151
Inspection and Repair 152
Assembly 153

151. DISASSEMBLY.

To disassemble the axle, remove the axle shaft nut lock ring, and remove the axle shaft nut, flat washer, and seal (fig. 34). Remove the hub from the axle shaft (fig. 33). Remove the cap screws and nuts that secure the brake support plate to the axle shaft housing, and remove the brake support plate assembly. Remove the oil seal retainer from the bearing retainer (fig. 34). Repeat this procedure to remove the other brake support plate. Remove the brake dust shield assembly and the oil seal. Be sure to keep the shim pack intact to facilitate reassembly.

Lift the axle shafts from the axle housing. Remove the nuts that secure the left-hand axle housing to the center housing, and remove the axle housing. Lift the differential from the center housing (fig. 35). Remove the right-hand axle housing from the center housing.

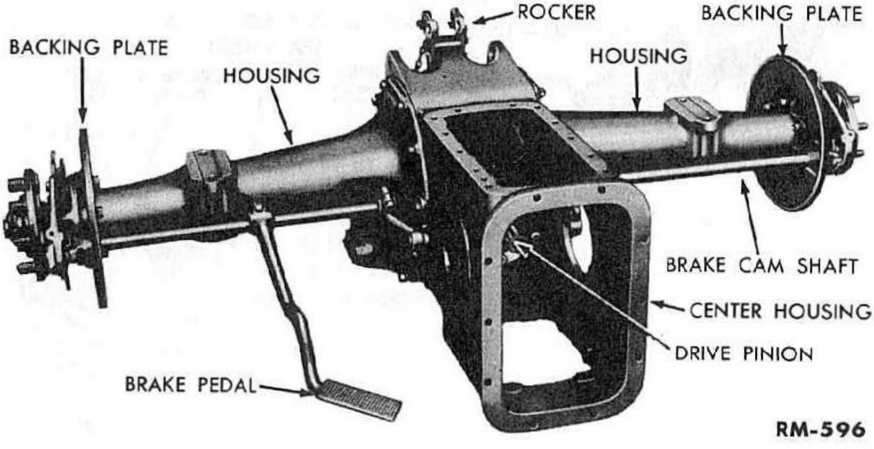


Fig. 32—Rear Axle Assembly

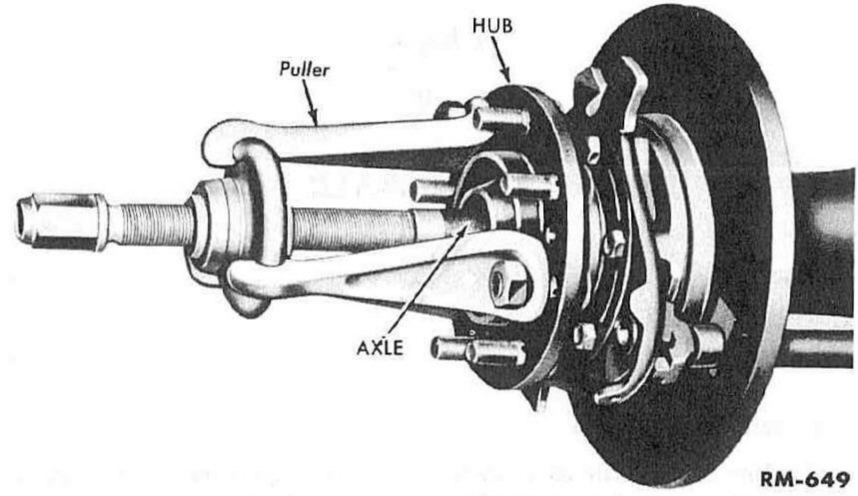


Fig. 33—Removing Hub From Axle

Place the differential assembly on a bench, and remove the lock wire and eight case bolts that secure the differential gear case to the drive gear assembly. Separate the two halves. If necessary, use a brass hammer to tap the two halves apart. Remove the differential spider, together with the differential pinions and thrust washers, from the differential gear case (fig. 35). Remove the differential side gears and thrust washers.

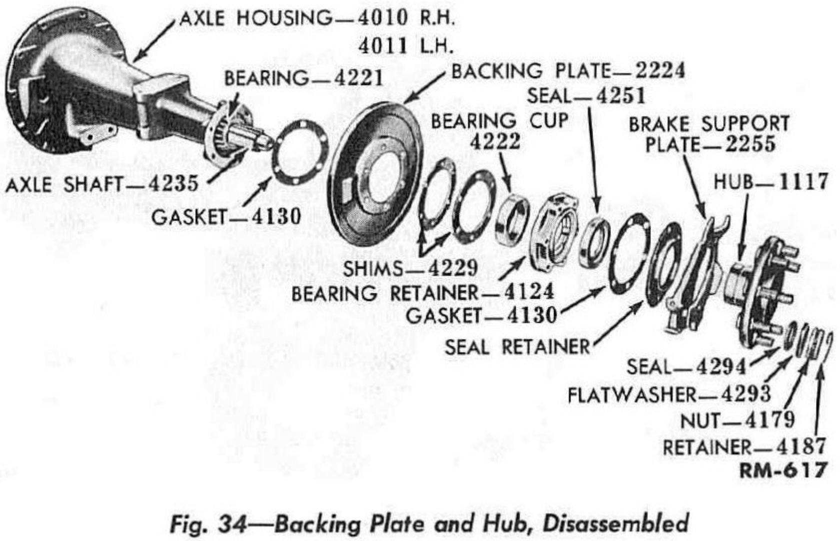


Fig. 34—Backing Plate and Hub, Disassembled

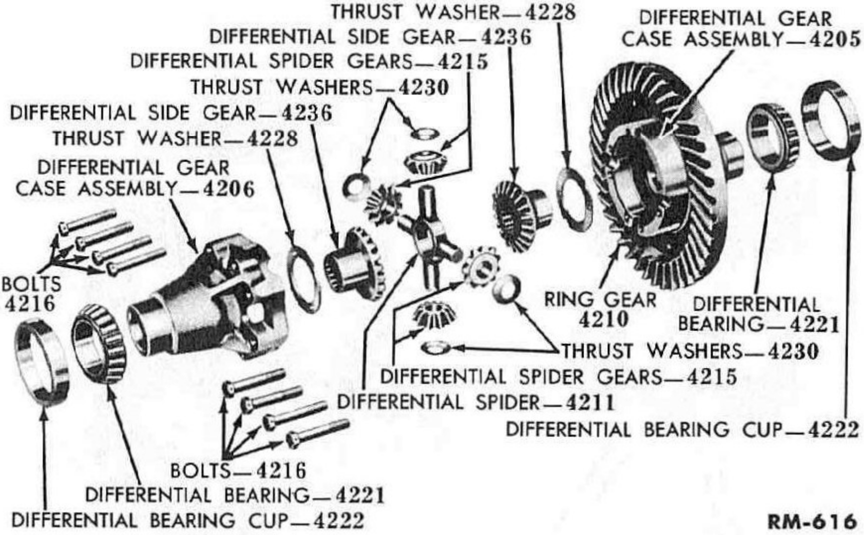

THRUST WASHER—4228
DIFFERENTIAL SIDE GEAR—4236
DIFFERENTIAL SPIDER GEARS—4215
THRUST WASHERS—4230
DIFFERENTIAL SIDE GEAR—4236
THRUST WASHER—4228
DIFFERENTIAL GEAR CASE ASSEMBLY—4206
DIFFERENTIAL GEAR CASE ASSEMBLY—4205
BOLTS 4216
RING GEAR 4210
DIFFERENTIAL BEARING—4221
THRUST WASHERS—4230
DIFFERENTIAL SPIDER GEARS—4215
DIFFERENTIAL SPIDER—4211
DIFFERENTIAL BEARING CUP—4222
BOLTS—4216
DIFFERENTIAL BEARING—4221
DIFFERENTIAL BEARING CUP—4222
RM-616

Fig. 35—Differential Assembly, Disassembled

Remove the six cap screws that secure the drive pinion sleeve to the center housing. Install the puller, as shown in fig. 36, and remove the pinion assembly.

Place the pinion assembly in a vise equipped with brass jaws. Bend the ears of the lock washer off the pinion bearing lock nut. Using two thin 2⅛ inch open-end wrenches, remove the pinion sleeve, thrust washer, and roller bearing from the pinion (fig. 42).

152. INSPECTION AND REPAIR.

Clean all parts thoroughly in cleaning fluid, and blow them dry. Discard all used gaskets and oil seals.

a. Axle Housing. Replace the axle housing and the center housing if they are cracked or bent. Replace the differential bearing cups at the inner end of the axle housings if they are pitted, corroded or discolored due to overheating (subpar. (1) below). Replace the thrust block on the left-hand axle housing if it shows wear. Replace the drive pinion pilot bearing in the center housing if the rollers have any flat spots, are discolored due to overheating, are pitted, or if they bind when rotated by hand (subpar. (3) below).

(1) *DIFFERENTIAL BEARING CUP REPLACEMENT*. To remove the differential bearing cups from either the right- or left-hand axle housing, use a puller that hooks behind the bearing cup. To install the bearing cup in either the right- or left-hand axle housing, use a replacer that pulls the bearing cup in place evenly, and draw the cup in flush with the shoulder in the axle housing.

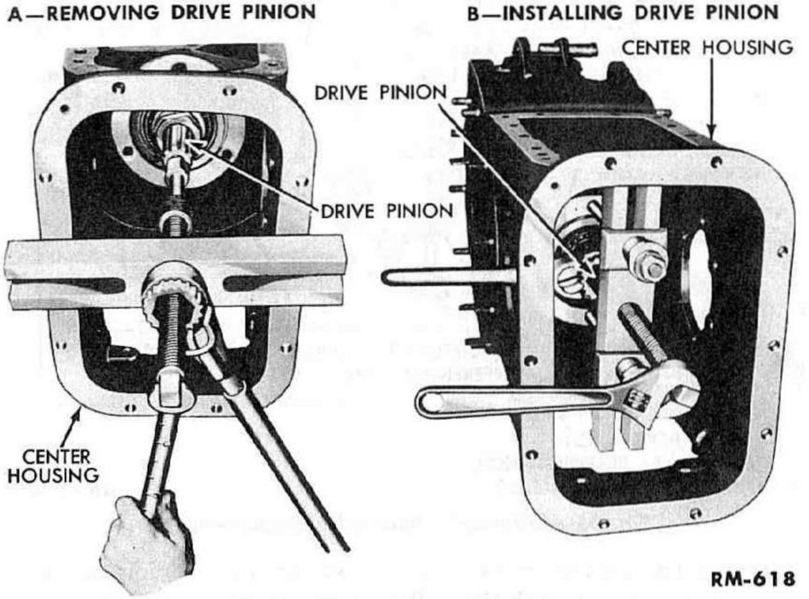


Fig. 36—Removing Drive Pinion Assembly

(2) *THRUST BLOCK REPLACEMENT*. To remove the thrust block, remove the two cap screws which secure the thrust block to the axle housing, and remove the block. To install, position the block in place on the housing, and install the two lock washers and cap screws.

(3) *DRIVE PINION PILOT BEARING REPLACEMENT*. Remove the pilot bearing, using a puller that applies pressure on the bearing outer race (fig. 37). To install a new pilot bearing, place the pilot bearing in position in the housing, and install the bearing, using a tool that applies pressure on the bearing outer race.

b. Differential Assembly. The drive gear assembly (including the differential gear case) and the drive pinion are furnished only in matched sets, and, if either is damaged, both must be replaced. Replace the drive gear assembly if it has chipped or missing teeth, or loose or missing drive gear rivets. Rotate the bearings on the drive gear assembly and the differential gear case by hand. If either bearing binds, has excessively loose races, is pitted, or is discolored due to overheating, replace the bearings (subpar. (1) below).

Replace the differential spider if the diameter is excessively worn at the differential spider gear bearing surfaces. Replace the differential

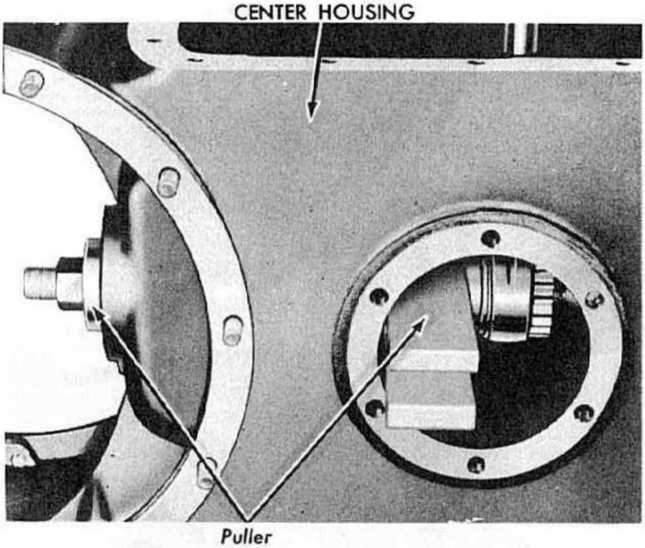


Fig. 37—Removing Drive Pinion Pilot Bearing

spider gears if they have chipped, pitted, or missing teeth, or if the inside diameter is excessively worn. Replace the differential side gears if they have broken, chipped, pitted, or excessively worn teeth or splines.

Insert a new axle shaft in the differential side gear. If the backlash is excessive, replace the differential side gear. Replace the differential spider gear thrust washer if excessively worn.

(1) *DIFFERENTIAL BEARING REPLACEMENT.* Remove the bearing from either the drive gear assembly or the differential case, using a puller that applies pressure to the inner race (fig. 39). To install a new bearing on the drive gear assembly or differential case, place either part in a press and, with a driver that applies pressure to the inner race evenly, press the bearing on the case until it is firmly seated on the shoulder of the case.

c. Drive Pinion Assembly. The drive gear assembly and the pinion gear are furnished only in matched sets, and if either is damaged, both must be replaced. Replace the drive pinion sleeve if it is cracked. Replace the drive pinion bearing cups in the sleeve if they are cracked, pitted, corroded, or discolored due to overheating (subpar. (1) below). Replace the drive pinion if the gear has chipped, pitted, or missing teeth, or if the shaft has damaged threads or splines. Replace the pilot bearing inner race at the end of the drive

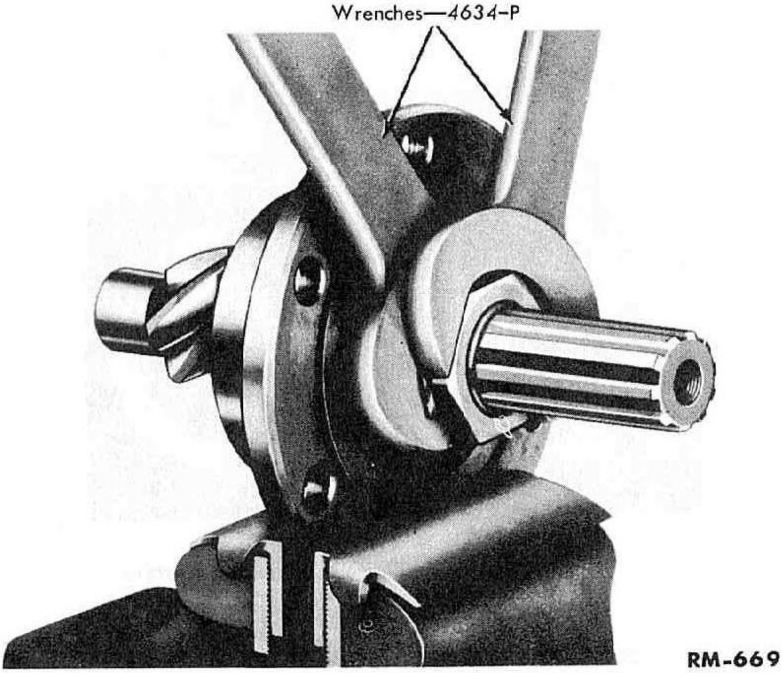


Fig. 38—Installing Drive Pinion Assembly

pinion if it is badly scored (subpar. (3) below). Rotate the bearing on the drive pinion by hand. If it binds, has excessively loose races or is discolored due to overheating, the bearing must be replaced (subpar. (2) below).

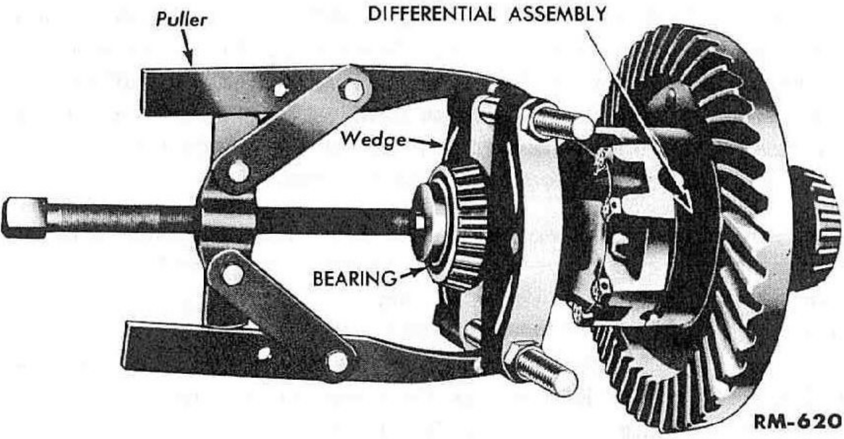


Fig. 39—Removing Differential Bearing

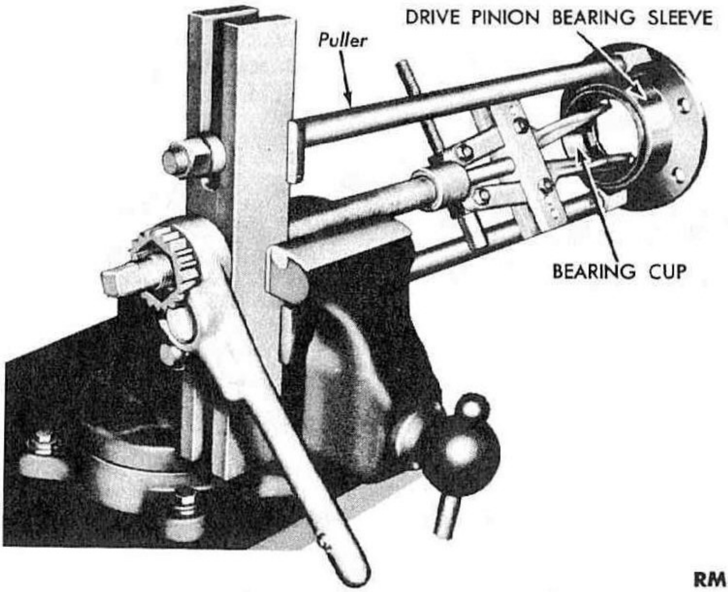


Fig. 40—Removing Drive Pinion Bearing Outer Race

(1) *DRIVE PINION BEARING CUP REPLACEMENT*. Place the drive pinion sleeve in a vise and, using a puller that hooks behind the bearing cup, pull the bearing cup (fig. 40). Repeat this operation to remove the other cup. To install new bearing cups, place the pinion sleeve in a vise. Place the cups in position on the pinion sleeve and, using a replacer that contacts the bearing cups evenly, draw the cups in the sleeve until they are seated flush with the shoulder in the sleeve.

(2) *DRIVE PINION BEARING REPLACEMENT*. Remove the bearing from the pinion, using a puller that applies pressure to the inner race. Install a new bearing, using a puller that applies pressure to the inner race of the bearing.

(3) *DRIVE PINION PILOT BEARING INNER RACE REPLACEMENT*. Remove the lock ring, using a sharp punch. Place the drive pinion so that the race rests on a solid base and, with a two-pound hammer, strike repeated blows along the race surface. This will cause the race to expand slightly. Drive a sharp chisel between the rear edge of the race and the pinion shoulder to start the race. Drive the race off the pinion, using a heavy punch. To install a new race, place it on the pinion with the chamfered side facing the pinion. Press the race on the pinion until it is against the shoulder of the pinion. Install the lock ring.

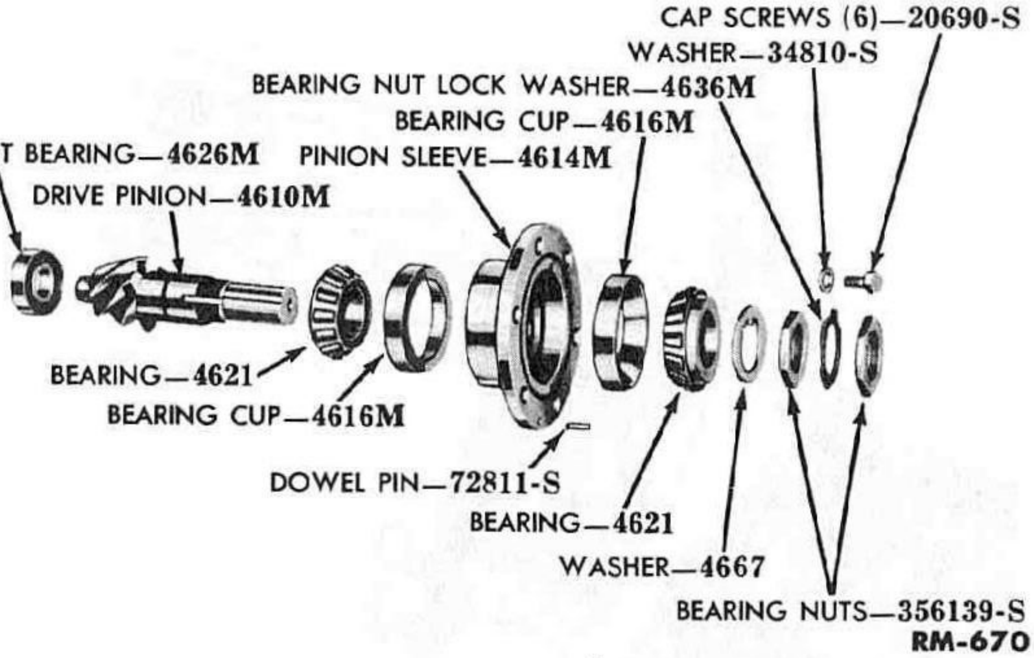


Fig. 41—Drive Pinion Assembly, Disassembled

d. Axle Shaft. Replace the axle shaft (fig. 36) if the splines or threads are damaged. Replace the axle shaft bearing (subpar. (1) below) if the rollers have flat spots or if any rollers are missing.

(1) *AXLE SHAFT BEARING REPLACEMENT.* Remove the axle shaft bearing with a puller that applies pressure on the inner race (fig. 42). To install the bearing, press it on the shaft, making sure all pressure is applied to the inner race (fig. 43).

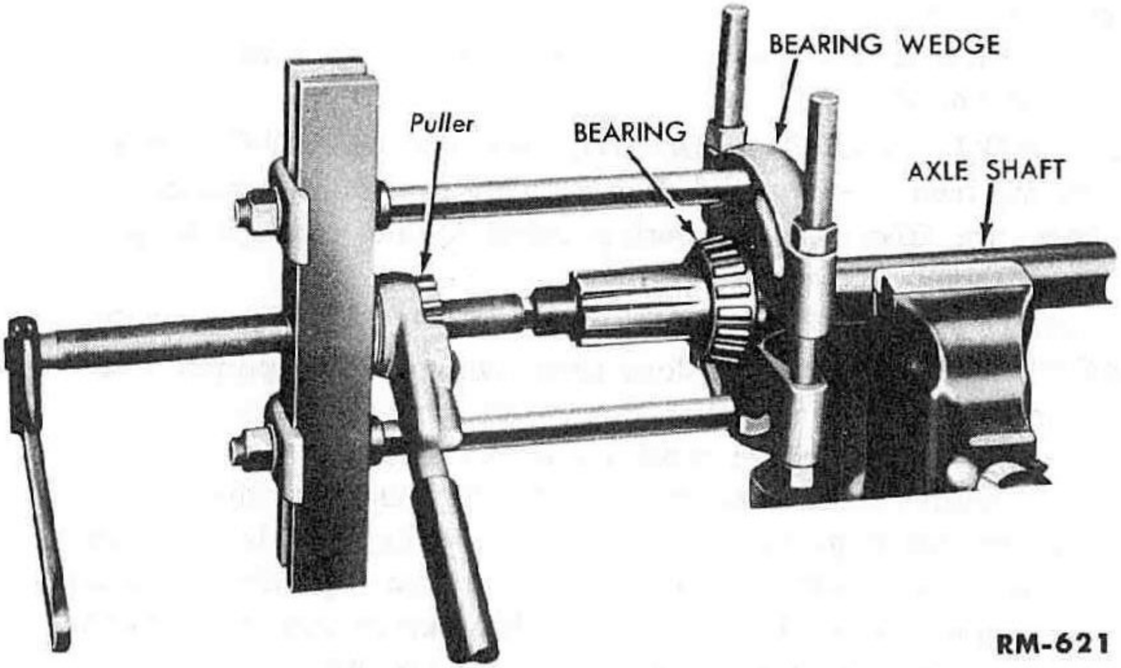


Fig. 42—Removing Axle Shaft Bearing

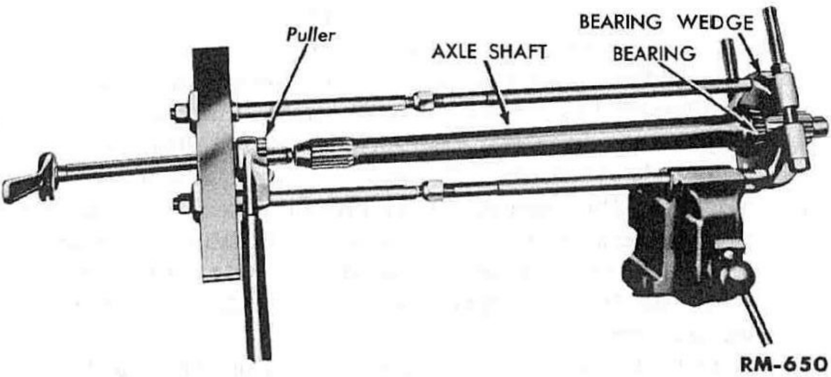


Fig. 43—Installing Axle Shaft Bearing

e. Axle Shaft Bearing Retainer. Replace the bearing race (subpar. (1) below) if it is scored or pitted. Discard all used gaskets and oil seals.

(1) *REAR AXLE OIL SEAL AND BEARING RACE REPLACEMENT.* To remove the rear axle oil seal or bearing race, drive it out of the retainer with a brass drift. To install, drive it into the retainer with a driver that applies pressure evenly on the race or oil seal.

153. ASSEMBLY.

Place the drive pinion sleeve in a vise equipped with brass jaws. Be sure that the bearings are thoroughly clean and that they have not been lubricated. The lubricant should not be applied to the bearings until after the bearing tension has been adjusted. Slide the drive pinion and bearing in the sleeve. Place the other bearing and the thrust washer on the pinion. Install the bearing adjusting nut and tighten the nut, using two 2⅛-inch thin, open end wrenches, until a torque of 12 to 16 pounds-inches is required to turn the pinion. After the correct adjustment is obtained, hold the adjusting nut with the wrench, and install the lock washer and lock nut. Tighten the lock nut while holding the adjusting nut stationary. Recheck the torque. Bend the tabs of the lock washer over both the lock nut and the adjusting nut.

Be sure that the drive pinion surface on the center housing has no nicks or high spots. Place the drive pinion assembly in position on the center housing. Line up the dowel pin in the sleeve of the pinion with the hole in the housing. Install the pinion assembly by applying pressure to the drive pinion shaft (fig. 38). Install the six cap screws that secure the pinion to the housing. Place the thrust washer and differential side gear in the drive gear assembly.

Install the four differential spider pinion gears and thrust washers on the differential spider and place the spider, including the gears, in position on the drive gear assembly. Install the thrust washer and differential side gear in the differential gear case. Line up the matching numbers on the drive gear assembly and differential gear case so that the numbers are directly opposite each other. Place the two assemblies together. Install the eight bolts that secure the two assemblies together and tighten them evenly. Lock the eight bolts with locking wire.

Be sure that the differential side bearings are thoroughly clean, and apply a thin coating of grease on the bearings. Place a new gasket on the right-hand side of the center housing. Position the right-hand axle housing on the center housing. Install and tighten the nuts. Position the differential assembly in the center housing with the flat side of the drive gear facing the left-hand axle housing. Place a new gasket on the center housing. Position the axle housing on the center housing. Install and tighten the nuts.

Install the axle shafts in the housings. Install the gaskets and the oil seal retainers on the bearing retainers. Secure the brake shoe brackets to the bearing retainers with two cap screws in each bracket. Coat each axle housing flange with a light film of grease. Position the gaskets on the axle housings.

Remove several of the shims of the shim pack previously used on the bearing retainer, and place the remainder of the pack between the brake plate and the bearing retainer. Hold the brake cross shaft in position, and install the brake plate and bearing retainer assembly on the axle housing. Rotation of one axle shaft should now cause the other shaft to rotate in the same direction. If it does not, more shims must be removed.

Increase the shim pack thickness in steps of approximately 0.005 inch. It may be necessary to exchange thick shims for thin ones, or vice versa, to produce the required addition. The shim thickness must be increased until the rotation of one shaft causes the other to rotate in the opposite direction. By following this procedure, the amount of end play in the axles will be held to the desired limits (0.002 to 0.004 inch).

Install the hubs, seals, flat washers, nuts, and lock rings.

Chapter

VI

POWER TAKE-OFF

Section

Disassembly 161

Inspection and Repair 162

Assembly 163

161. DISASSEMBLY.

The disassembled power take-off assembly is shown in fig. 48.

a. Power Take-off Adapter. To disassemble the power take-off adapter, remove the three cap screws which secure the shield and bearing cap (fig. 44) to the housing. Remove the shield and bearing cap from the housing. Drive the bearing and shaft assembly out of the housing. Grind the head off the rivet that secures the sleeve to the shaft. Remove the rivet from the shaft and sleeve. Pull the sleeve off the shaft. Remove the oil seal from the housing.

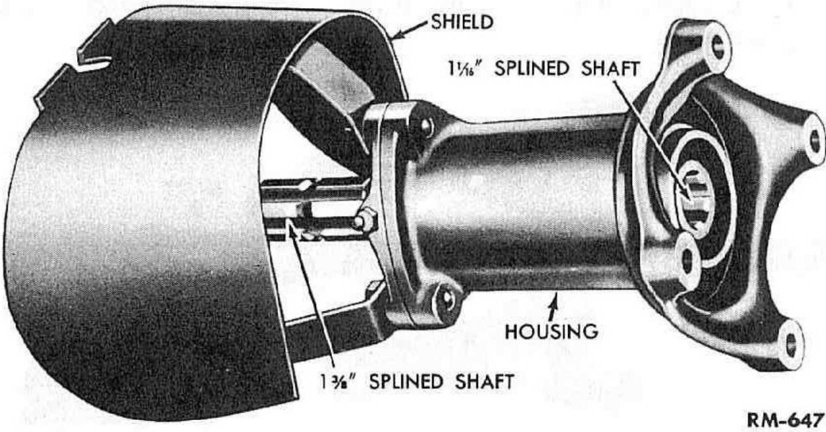


Fig. 44—Power Take-off Adapter

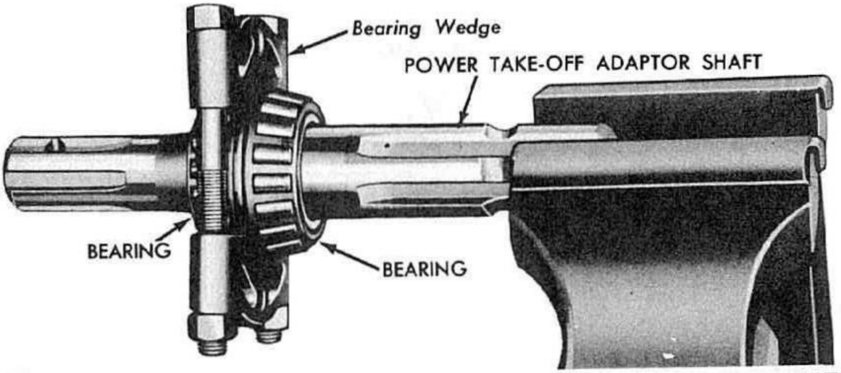


Fig. 45—Separating Power Take-off Adapter Shaft Bearings

b. Power Take-off Shaft. Remove the snap ring from the rear of the bearing. Press the shaft and bearing assembly from the power take-off cover. Press the dust and oil seal out of the power take-off cover (fig. 48).

162. INSPECTION AND REPAIR.

Clean all parts thoroughly in cleaning fluid. Discard all used gaskets and oil seals.

a. Power Take-off Adapter. The adapter assembly comprises the guard, shaft, sleeve, bearing, bearing race, and housing.

(1) *GUARD*. Replace the guard (fig. 47) if it is distorted or bent beyond repair.

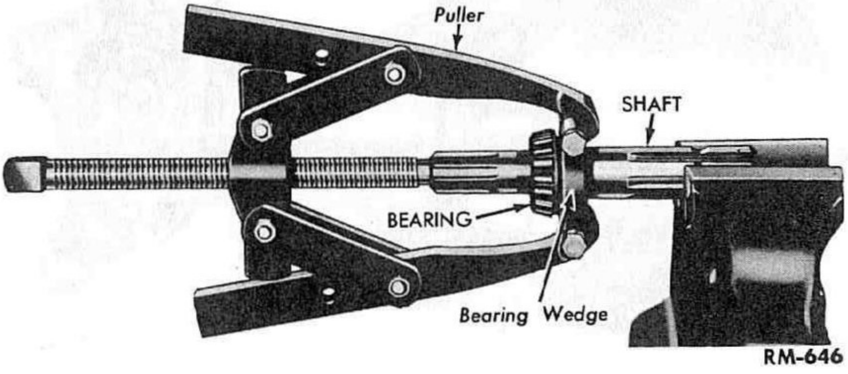


Fig. 46—Removing Power Take-off Adapter Shaft Bearings

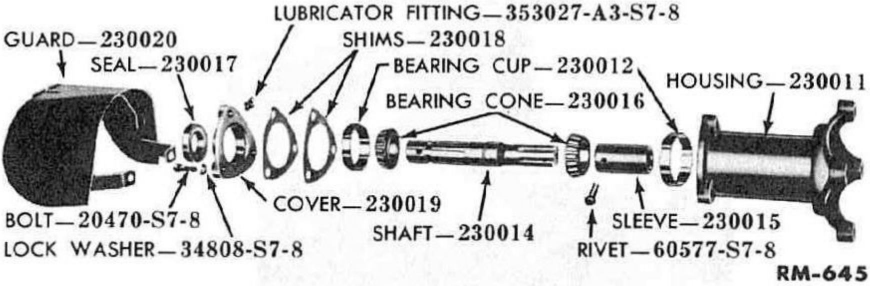


Fig. 47—Power Take-off Adapter, Disassembled

(2) *SHAFT.* Replace the shaft (fig. 47) if it is broken or if the splines are worn or damaged.

(3) *SLEEVE.* Replace the sleeve if the splines are worn or damaged.

(4) *BEARING.* Replace the bearing (fig. 47) if any of the rollers are missing, if they have flat spots, or if the surfaces are pitted or corroded. Separate the bearings with a bearing wedge and remove them with a puller as shown in figs. 45 and 46.

(5) *BEARING RACE.* Replace a bearing race that is scored, worn or pitted.

(6) *HOUSING.* Replace the housing if it is cracked or if the threads are stripped.

b. Power Take-off Shaft. Replace the shaft and bearing assembly (fig. 48) if the splines are damaged, if the bearing is scored, or corroded, if the bearing race is loose, or if the oil and dust seal surfaces are damaged. Always replace the oil seal if it has been removed.

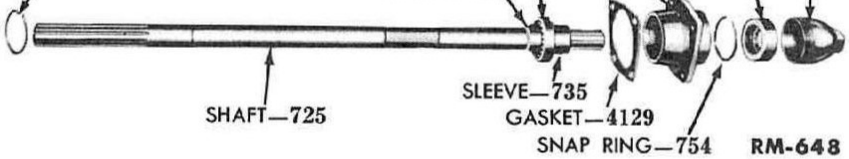


Fig. 48—Power Take-off Shaft, Disassembled

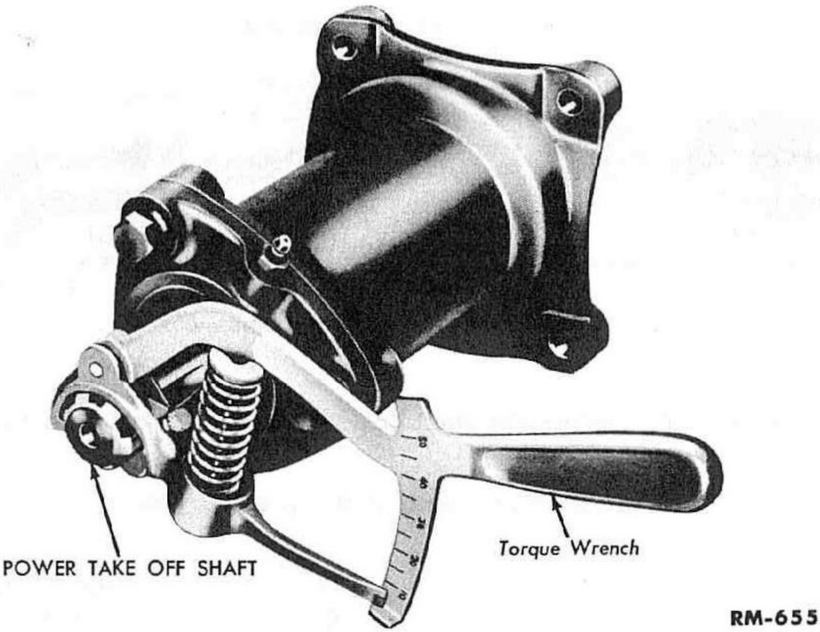


Fig. 49—Checking Bearing Preload

163. ASSEMBLY.

To assemble the power take-off adapter, position the sleeve on the shaft, and secure it to the shaft with a rivet (fig. 47). Install the bearing and shaft assembly in the housing with the sleeve end of the shaft towards the rear of the housing (fig. 47). Press the oil seal (fig. 47) in the bearing retainer. Install the bearing retainer, shims, and guard on the housing. Adjust the preload to 5 to 12 pounds-inches by increasing the shim pack to reduce the preload or by decreasing the shim pack to increase the preload.

To assemble the power take-off shaft assembly, press the oil seal (fig. 48) in the cover. Press the cover assembly onto the shaft and bearing. Install the rear snap ring in the cover. Install the cover cap.

Chapter

VII

BELT PULLEY

Section

Disassembly 171

Inspection and Repair 172

Assembly 173

171. DISASSEMBLY.

Remove the filler plug (fig. 50) and allow the oil to drain. Remove the four cap screws that secure the cover to the housing. Remove the cover and gasket. Remove the cotter pin, castellated nut, washer, driven gear, and bearing from the pulley shaft. Tap on the side of the pulley to remove the shaft from the housing. Remove the four cap screws that hold the pulley to the shaft. Remove the pulley. Lift the drive gear and bearing assembly from the housing. Remove both oil seals from the housing.

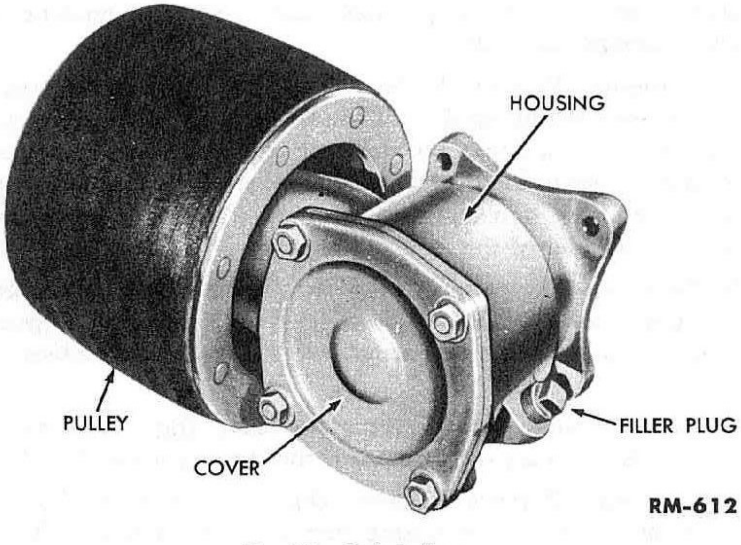


Fig. 50—Belt Pulley

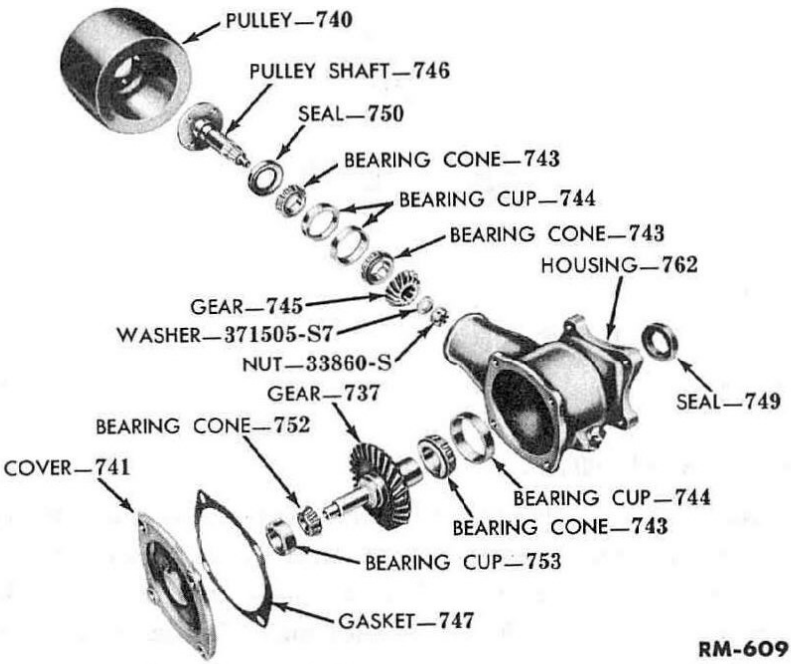


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Fig. 51—Belt Pulley, Disassembled

172. INSPECTION AND REPAIR.

Clean all parts thoroughly in cleaning fluid. Discard all used gaskets and oil seals. Inspection must cover the housing, gears, shaft, bearings, and pulley.

a. **Housing.** Replace the housing (fig. 51) if it is cracked, if the gasket surface is damaged, or if the threads are stripped. Replace a bearing race if it is pitted, corroded, or cracked. To remove a bearing race, drive it out of the housing with a brass drift. To install the race, drive it into the housing with a driver that will apply pressure evenly on all sides of the race.

b. **Drive and Driven Gears (Matched).** Replace both gears if either gear has broken, chipped, or worn teeth, if the gears are excessively noisy when operating, or if the oil seal surface on the drive gear is damaged.

c. **Pulley Shaft.** Replace the pulley shaft (fig. 51) if the splines or oil seal surfaces are damaged or if the threads are stripped.

d. **Bearings.** Replace a bearing (fig. 51) that is pitted, corroded, or if any of the rollers are missing. Remove the bearings with a puller as shown in fig. 52.

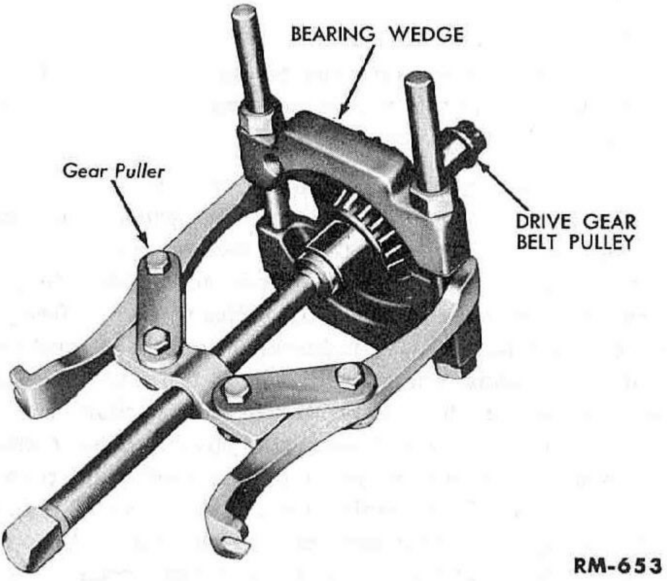

Fig. 52—Removing Bearing from Drive Gear

e. Pulley. Replace a pulley (fig. 51) if the belt surface is worn or if it is loose on the hub.

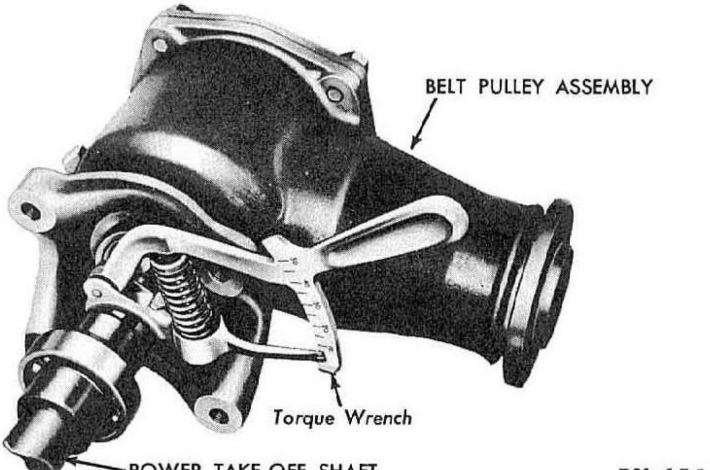

Fig. 53—Checking Driven and Drive Gear Torque

173. ASSEMBLY.

Install new oil seals in the drive shaft and pulley sides of the housing (fig. 51). Make sure the pulley shaft outer bearing inner race is in place before this seal is installed. Install the drive gear and bearing assembly in the housing.

Position the pulley shaft assembly part way in the housing, and install the inner bearing, driven gear, flat washer, and nut on the shaft. Tighten the nut, then tap the pulley shaft into the housing with a rawhide hammer. Repeat this procedure until the pulley shaft requires a torque of 5 to 12 pounds-inches to turn it freely. Install a cotter pin in the nut and shaft. Install a new gasket and position the cover on the housing. Install and tighten the four lock washers and cap screws. Secure the pulley to the pulley shaft with four cap screws and lock washers. Insert the power take-off shaft in the splines. Install a torque indicator on the shaft, and turn the shaft with the indicator. The reading should be 15 to 34 pounds-inches. Gaskets are supplied in thicknesses ranging from 0.012 to 0.023 inch. Install a thicker gasket to decrease the torque reading or a thinner gasket to increase the reading.